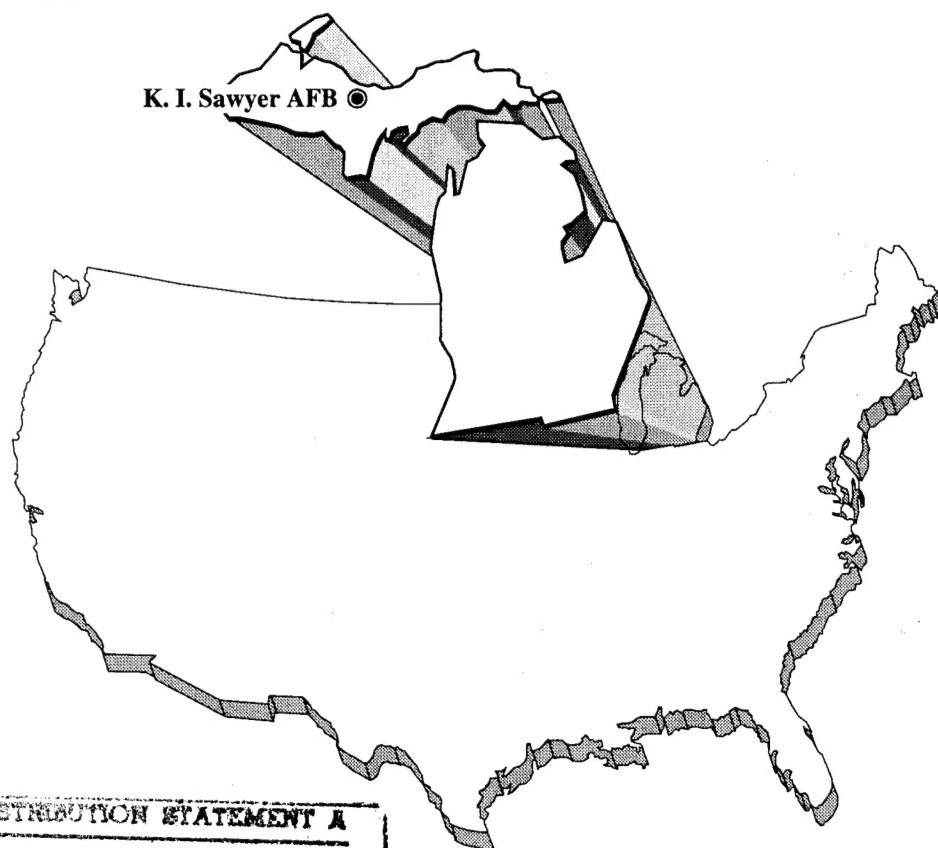




FINAL
ENVIRONMENTAL IMPACT STATEMENT
February 1996

Volume II
Appendices



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DISPOSAL OF
K. I. SAWYER AIR FORCE BASE, MICHIGAN

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**VOLUME II
APPENDICES**

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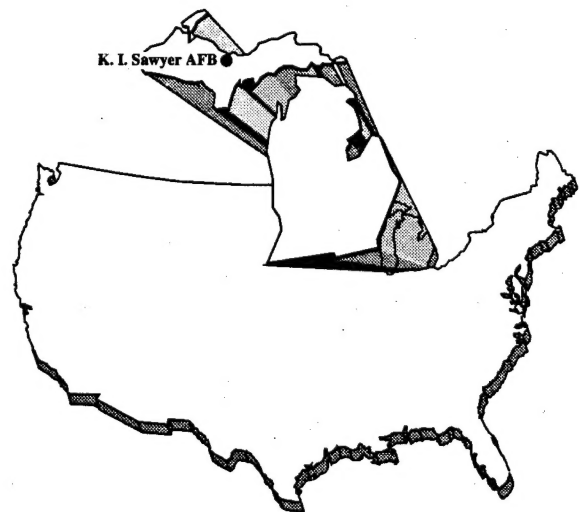


TABLE OF CONTENTS

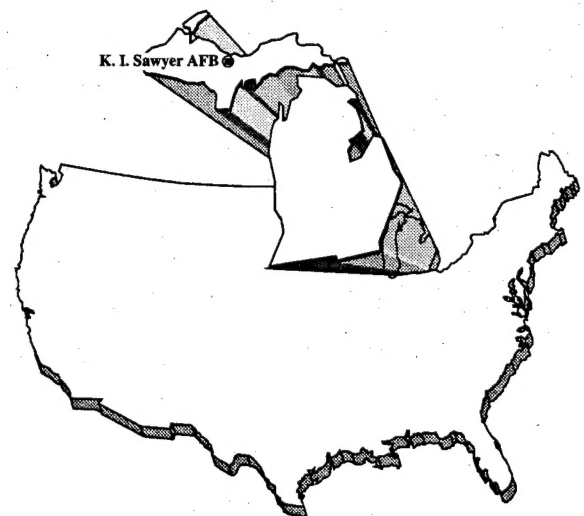
TABLE OF CONTENTS

VOLUME II

APPENDICES

- A - Glossary of Terms and Acronyms/Abbreviations**
- B - Notice of Intent**
- C - Final Environmental Impact Statement Mailing List**
- D - K. I. Sawyer Air Force Base Installation Restoration Program Bibliography and Site Descriptions**
- E - Methods of Analysis**
- F - Environmental Permits Held by K. I. Sawyer Air Force Base**
- G - Storage Tanks, Oil/Water Separators, Pesticide Storage, and Solid Waste Management Units and Areas of Concern at K. I. Sawyer Air Force Base**
- H - Air Force Policy for Management of Asbestos-Containing Material at Closure Bases and Results of K. I. Sawyer Air Force Base Asbestos Survey**
- I - Air Quality Analysis Methods and Air Emissions Inventory for K. I. Sawyer Air Force Base**
- J - Noise**
- K - Biological Resources**
- L - Farmland Conversion Impact Rating Form AD-1006**
- M - Agency Letters and Certifications**
- N - Influencing Factors and Environmental Impacts by Land Use Category**

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APPENDIX A

APPENDIX A
GLOSSARY OF TERMS AND ACRONYMS/ABBREVIATIONS

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GLOSSARY OF TERMS

A-Weighted Sound Level. A number representing the sound level that is frequency weighted according to a prescribed frequency response established by the American National Standards Institute (ANSI S1.4-1971) and accounts for the response of the human ear.

Abatement. Any set of measures designed to permanently eliminate health and environmental hazards. These may include (1) removal, permanent containment or encapsulation, or replacement and (2) all preparation, cleanup, disposal, and postabatement clearance testing activities associated with such measures.

Accident Potential Zone (APZ). APZs include a 3,000-foot by 3,000-foot clear zone at each end of the runway and areas designated as APZ I and APZ II extending beyond the clear zone. The accident potential in the clear zone is so high that necessary land use restrictions prohibit reasonable economic use of the land. APZ I is less critical, but still possesses a significant risk factor. APZ I is a 3,000-foot by 5,000-foot area with land use compatibility guidelines that are sufficiently flexible to allow reasonable economic use of the land. APZ II is less critical than APZ I; APZ II is a 3,000-foot by 7,000-foot area, extending to 15,000 feet from the runway threshold.

Acoustics. The science of sound, which includes the generation, transmission, and effects of sound waves, both audible and inaudible.

Advisory Council on Historic Preservation. A 19-member body appointed, in part, by the President of the United States to advise the President and Congress, and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (Public Law [P.L.] 89-655; 16 U.S. Code 470).

Aesthetics. Referring to the perception of beauty.

Air Installation Compatible Use Zone (AICUZ). A concept developed by the Air Force to promote land use development near its airfields in a manner that protects adjacent communities from noise and safety hazards associated with aircraft operations, and to preserve the operational integrity of the airfields.

Aircraft operation. A takeoff or landing at an airport.

Alluvium. Clay, silt, sand, gravel, or similar material deposited by running water.

Ambient Air Quality Standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated "criteria" pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone, and lead), to protect public health with an adequate margin of safety (primary standards) and to protect public welfare including plant and animal life, visibility, and materials (secondary standards).

Amplitude. The maximum value of a periodically varying quantity during a cycle.

Aquifer. The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Archaean. The oldest portion of the Precambrian; rocks that have been dated from the Archaean and range from approximately 2.8 to 3.3 billion years old.

Archaeology. A scientific approach to the study of human ecology, cultural history, and cultural process.

Area of Concern. A location where contamination is likely or suspected, but where further investigation is needed to confirm its presence and whether it is below action levels.

Asbestos. A group of naturally occurring minerals that separate into fibers, including chrysotile, amosite, crocidolite, asbestiform anthophyllite, asbestiform tremolite, and asbestiform actinolite.

Asbestos-containing material. As defined by the Toxic Substances Control Act, asbestos-containing material is any material which contains more than 1 percent asbestos by weight.

Attainment area. A region that meets the National Ambient Air Quality Standards for a criteria pollutant under the Clean Air Act.

Average annual daily traffic (AADT). For a 1-year period, the total volume passing a point or segment of a highway facility in both directions, divided by the number of days in the year.

Average daily traffic (ADT). The typical 24-hour volume of traffic passing a given point or segment of a roadway in both directions.

Base Realignment and Closure (BRAC). Collectively, the Base Closure and Realignment Act of 1988 (Public Law 100-526, 102 Stat. 2623) (also called BRAC 88, or Round I) and the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, 104 Stat. 1808) (also called BRAC 91, 93, and 95, or Round II, Round III, and Round IV). Department of Defense installations subject to closure or realignment pursuant to these laws are referred to as BRAC installations.

Best management practices (BMPs). Practical and economically achievable methods used to prevent environmental degradation and increase long-term forest health and vigor.

Board foot. Lumber or timber measurement term indicating the amount of wood contained in an unfinished board one inch thick, 12 inches long, and 12 inches wide.

Bi-National Program to Restore and Protect the Lake Superior Basin. In its fifth Biennial Report on Great Lakes Water Quality, the International Joint Commission recommended that "the Parties designate Lake Superior as a demonstration area where no point source discharge of any persistent toxic chemical will be permitted." This document identifies the response of the federal governments of the United States and Canada; the states of Minnesota, Wisconsin, and Michigan, and the Province of Ontario to this recommendation.

Biological Resources. Include the native and introduced plants and animals in the project area.

Biophysical. Pertaining to the physical and biological environment, including the environmental conditions crafted by man.

Bioventing. A remedial technique that injects air into the soils to stimulate bacterial consumption, thus accelerating the breakdown of petroleum-based contaminants in the soils.

Block cut. An even-aged management silvicultural system that results in removal of all merchantable timber in areas less than 5 acres and cut in a rectangular pattern.

Boreal. Literally, "of the North." The boreal zone is the geographical region where short summers and long, cold winters occur, characterized by coniferous forests.

BRAC Cleanup Team (BCT). At each Department of Defense closing or realigning installation where property will be available for transfer to the community, the BCT has authority, responsibility, and accountability for environmental cleanup programs, emphasizing those actions that are necessary to facilitate reuse and redevelopment. BCT members are the base BRAC Environmental Coordinator, the state BCT representative, and the U.S. Environmental Protection Agency BCT representative.

Bucking. Cutting trees or tree parts to predetermined lengths.

Bunching. Collecting and arranging stems or stem parts into piles in the strip.

Cambrian. The oldest Period in the Paleozoic Era, characterized in the fossil record by the first abundant amounts of life; ranges from 500 to 570 million years ago.

Canopy. The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody ground material.

Capacity. The maximum rate of flow at which vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions.

Carbon monoxide (CO). A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion. One of the six pollutants for which there is a national ambient standard. See Criteria Pollutants.

Class I, II, and III Areas. Area classifications, defined by the Clean Air Act, for which there are established limits to the annual amount of air pollution increase. Class I areas include international parks, and certain national parks and wilderness areas; allowable increases in air pollution are very limited. Air pollution increases in Class II areas are less limited, and are least limited in Class III areas. Areas not designated as Class I start out as Class II and may be reclassified up or down by the state, subject to federal requirements.

Clearcutting. An even-aged management silvicultural system that results in removal of all timber in a contiguous area of 5 acres or more.

Clear Zone. A 3,000-foot by 3,000-foot area at each end of a military runway where the overall accident risk is so high that necessary land use restrictions would prohibit reasonable economic use of the land.

Commercial aviation. Aircraft activity licensed by state or federal authority to transport passengers and/or cargo for hire on a scheduled or nonscheduled basis.

Comprehensive Plan. A public document, usually consisting of maps, text, and supporting materials, adopted and approved by a local government legislative body, which describes future land uses, goals, and policies.

Conifer. Any tree of the order Gymnospermae, which are predominantly evergreen, cone-bearing trees with needles or scale-like leaves, such as pine, spruce, hemlock, or fir, and producing timber known commercially as softwood.

Contaminants. Undesirable substances rendering something unfit for use.

Control zone. Controlled airspace that extends upward from the surface of the earth and terminates at the base of the Continental Control Area. Control zones that do not underlie the Continental Control Area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles and any extensions necessary to include instrument approach and departure paths.

Convey. To deliver title of property to a nonfederal entity.

Council on Environmental Quality (CEQ). Established by the National Environmental Policy Act (NEPA), the CEQ consists of three members appointed by the President. CEQ regulations (40 Code of Federal Regulations 1500-1508, as of July 1, 1986) described the process for implementing NEPA, including preparation of environmental assessments and environmental impact statements, and the timing and extent of public participation.

Craton. A stable, relatively immobile area of the earth's crust that forms the nuclear mass of a continent or the central basin of an ocean.

Criteria pollutants. The Clean Air Act required the U.S. Environmental Protection Agency to set air quality standards for common and widespread pollutants after preparing "criteria documents" summarizing scientific knowledge on their health effects. Today there are standards in effect for six "criteria pollutants": sulfur dioxide (SO₂), carbon monoxide (CO), particulate matter equal to or less than 10 microns in diameter (PM₁₀), nitrogen dioxide (NO₂), ozone (O₃), and lead (Pb).

Cultural resources. Prehistoric and historic districts, sites, buildings, objects, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, religious, or any other reason.

Cumulative impacts. The combined impacts resulting from all activities occurring concurrently at a given location.

Day-night average sound level (DNL). The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance due to noise during night hours.

Decibel (dB). A unit of measurement on a logarithmic scale that describes the magnitude of a particular quantity of sound pressure or power with respect to a standard reference value.

Defense Environmental Restoration Account (DERA). Department of Defense account from which Installation Restoration Program activities are funded.

Disposal. Orderly placement or distribution of property.

Easement. A right or privilege (agreement) that a person may have on another's property.

Effluent. Waste material discharged into the environment.

Endangered Species. A species that is threatened with extinction throughout all or a significant portion of its range.

Environmental Impact Analysis Process (EIAP). The process of conducting environmental studies as outlined in Air Force Instruction 32-7061.

Equivalent sound level (L_{eq}). The equivalent steady-state sound level that, in a specified period of time, would contain the same acoustical energy as time-varying sound levels during the same period.

Erosion. Wearing away of soil and rock by weathering, and the action of streams, wind, and underground water.

Even-aged. Forest stand composed of trees having no or relatively small differences in age. By convention the maximum differences admissible are generally 10 to 20 years.

Excess property. Property that is reported to the General Services Administration as no longer required by a federal agency. This property is then made available to all other federal agencies.

Faults. Fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other and in a direction parallel to the fracture.

Felling. Separating trees at the stump from their growing site.

Feller-buncher. A machine used to fell trees and move them into bunches or windrows.

Fleet mix. Combination of aircraft used by a given agency.

Frequency. The time rate (number of times per second) that the wave of sound repeats itself, or that a vibrating object repeats itself--now expressed in Hertz, formerly in cycles per second.

General aviation. All aircraft that are not commercial or military aircraft.

Groundwater. Water within the earth that supplies wells and springs.

Hardwoods. A conventional term for the timber of broadleaved trees, and the trees themselves, belonging to the botanical group Angiospermae.

Harvester. A self-propelled machine which fells trees and performs at least two processing functions.

Hazardous Air Pollutant (HAP). One of 45 substances (originally 189 substances were listed in the 1990 Amendments) listed in the Clean Air Act as pollutants that present or may present a threat of adverse human health effects or adverse environmental effects when released into the air.

Hazardous materials/hazardous waste. Those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, and the Solid Waste Disposal Act, as amended, by the Resource Conservation and Recovery Act, as

amended. Generally, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare, or the environment when released into the environment.

Historic sites. Under the National Historic Preservation Act, these are properties of national, state, or local significance in American history, architecture, archaeology, engineering, or culture, and worthy of preservation.

Holocene. The younger epoch of the Quaternary period; also referred to as the recent epoch.

Hydrocarbons. Any of a vast family of compounds containing hydrogen and carbon. Used loosely to include many organic compounds in various combinations; most fossil fuels are composed predominately of hydrocarbons. When hydrocarbons mix with nitrogen oxides in the presence of sunlight, ozone is formed; hydrocarbons in the atmosphere contribute to the formation of ozone.

Hydrology. A science dealing with the properties, distribution, and circulation of water both above and below the earth's surface.

Impacts/Effects. An assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique. In this environmental impact statement, as well as in the CEQ regulations, the word impact is used synonymously with the word effect.

Indicator species. A species whose presence in a certain location or situation at a given population indicates a particular environmental condition. Their population changes are believed to indicate effects of management activities on a number of other species or water quality.

Ingrant. In this context, real estate and facilities outside the base boundary that are owned by agencies and private individuals, and made available for use by the Air Force through easement, license, permit, or lease.

Instrument Flight Rules (IFR). Rules governing the procedures for conducting instrument flight.

Kettle. A steep-sided, bowl-shaped hole or depression in glacial deposits, often containing a lake or a swamp, formed by the melting of a large, stagnant block of ice during glacial retreat; sediments are deposited around the ice so that a hole remains after the ice has melted.

Lead (Pb). A heavy metal used in many industries, which can accumulate in the body and cause a variety of negative effects. One of the six pollutants for which there is a national ambient air quality standard. See Criteria Pollutants.

Level of Service (LOS). In transportation analyses, a qualitative measure describing operational conditions within a traffic stream, and how they are perceived by motorists and/or passengers. In public services, a measure describing the amount of public services (e.g., fire protection, law enforcement services) available to community residents, generally expressed as the number of personnel providing the services per 1,000 population.

Loam, loamy. Rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

Mast. Nuts, acorns, and similar products of hardwood species, which are consumed by animals.

Mean sea level (MSL). The average height of the sea surface if undisturbed by waves, tides, or winds.

Medical/biohazardous waste. Material that includes, but is not limited to, isolation wastes, infectious agents, human blood and blood products, pathological wastes, sharps (e.g., scalpels, needles), body parts, contaminated bedding, surgical wastes and potentially contaminated laboratory wastes, and dialysis wastes.

Metamorphic rock. Rock altered from some other form of rock by heat and/or pressure changing original textures, mineral content, and other geochemical characteristics of the rock. Metamorphism can be slight (minimal changes to the original rock) to extensive (complete destruction of original character of the rock).

Micron. A unit of length equal to one millionth of a meter; also called a micrometer. There are approximately 25,400 microns per inch.

Military operations area (MOA). Airspace area of defined vertical and lateral limits established for the purpose of separating certain training activities such as air combat maneuvers, air intercepts, and aerobatics from other air traffic operating under IFR.

Military training route (MTR). Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at air speeds in excess of 250 knots.

Mineral. Naturally occurring inorganic element or compound.

Mitigation. A method or action to reduce or eliminate program impacts.

Mobile source. A moving source of air pollutants such as motor vehicle, airplane, train, or ship.

National Ambient Air Quality Standards (NAAQS). Section 109 of the Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set nationwide standards, the NAAQS, for widespread air pollutants. Currently, six pollutants are regulated by primary and secondary NAAQS: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀), and sulfur dioxide (SO₂). See Criteria Pollutants.

National Priorities List (NPL). A list of sites (federal and state) where release of hazardous materials may have occurred and may cause an unreasonable risk to the health and safety of individuals, property, or the environment.

National Register of Historic Places (NRHP). A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

Native Americans. Used in a collective sense to refer to individuals, bands, or tribes who trace their ancestry to indigenous populations of North America prior to Euro-American contact.

Native vegetation. Plant life that occurs naturally in an area without agricultural or cultivation efforts. It does not include species that have been introduced from other geographical areas and become naturalized.

National Environmental Policy Act (NEPA). P.L. 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities (e.g., population growth, high-density urbanization, industrial development) on the natural environment. NEPA also established the CEQ. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues in order to facilitate the decision-making process.

Nitrogen dioxide (NO₂). Gas formed primarily from atmospheric nitrogen and oxygen when combustion takes place at high temperature. NO₂ emissions contribute to acid deposition and formation of atmosphere ozone. One of the six pollutants for which there is a national ambient standard. See Criteria Pollutants.

Nitrogen oxides (NO_x). Gases formed primarily by fuel combustion, which contribute to the formation of acid rain. Hydrocarbons and NO_x combine in the presence of sunlight to form ozone, a major constituent of smog.

Noise. Any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing, or is otherwise annoying (unwanted sound).

Noise attenuation. The reduction of a noise level from a source by such means as distance, ground effects, or shielding.

Noise contour. A line connecting points of equal noise exposure on a map. Noise exposure is often expressed using the DNL.

Nonattainment area. An area that has been designated by the U.S. EPA or the appropriate state air quality agency, as exceeding one or more National or State Ambient Air Quality Standards.

100-year floodplain. The area where there is a 1 percent probability of a flood in a given year.

Operating Location (OL). An organizational element of the Air Force Base Conversion Agency located at a closing base. The OL is responsible for the care and custody of closed areas of the base, disposal of real and related personal property, and environmental cleanup. This office is the primary point of contact for local community reuse organizations and the general public who deal with the disposal and reuse of the base.

Ordnance. Military supplies including weapons, ammunition, combat vehicles, and maintenance tools and equipment.

Outgrant. In this context, real estate and facilities on the base that are made available, by the Air Force, for use by another agency or a private individual through easement, license, permit, or lease.

Outwash. Stratified sand and gravel deposited by meltwater flowing from a glacier out beyond the extent of the ice flow. Generally forms thick sequences that form a plain (outwash plain) downslope from the glacier.

Outwash Plain. See Outwash.

Ozone (O₃) (ground level). A major ingredient of smog. Ozone is produced from reactions of hydrocarbons and nitrogen oxides in the presence of sunlight and heat. Some 68 areas, mostly

metropolitan areas, did not meet a December 31, 1987, deadline in the Clean Air Act for attaining the ambient air quality standard for ozone.

Patch cut. An even-aged management silvicultural system that results in removal of all timber in areas less than 5 acres and cut in an irregular shape.

PCB-contaminated equipment. Equipment that contains a concentration of polychlorinated biphenyls (PCBs) (see definition) from 50 to 499 parts per million (ppm) and is regulated by the U.S. EPA.

PCB equipment. Equipment that contains a concentration of PCBs of 500 ppm or greater and is regulated by the U.S. EPA.

Peak-hour volume. The number of vehicles passing a given section of roadway between 7:00 a.m. and 9:00 a.m. or between 4:00 p.m. and 6:00 p.m.

Permeability. The capacity of a porous rock or sediment to transmit a fluid.

Pesticides. Any substance, organic or inorganic, used to destroy or inhibit the action of plant or animal pests; the term thus includes insecticides, herbicides, fungicides, rodenticides, miticides, fumigants, and repellents. All pesticides are toxic to humans to a greater or lesser degree. Pesticides vary in biodegradability.

Physiographic province. A region in which all parts are similar in geologic structure and climate.

Physiography. The science of the surface of the earth and the inter-relations of air, water, and land.

Pleistocene. An earlier epoch of the Quaternary period during the "ice age" beginning approximately 3 million years ago and ending 10,000 years ago. Also refers to the rocks and sediments deposited during that time.

Point source. A stack or other highly localized pollutant source, as compared to an area source.

Polychlorinated biphenyls (PCBs). Any of a family of industrial compounds produced by chlorination of biphenyl. These compounds are noted chiefly as an environmental pollutant that accumulates in organisms and concentrates in the food chain with resultant pathogenic (disease-causing) and teratogenic (deformity-causing) effects. They also decompose very slowly.

Precambrian. The portion of the stratigraphic sequence of the earth's history prior to 570 million years ago.

Prehistoric. The period of time before the written record.

Prevention of Significant Deterioration (PSD). In the 1977 amendments to the Clean Air Act, Congress mandated that areas with air cleaner than required by NAAQS must be protected from significant deterioration. The Clean Air Act's PSD program consists of two elements: requirements for best available control technology on major new or modified sources, and compliance with an air quality increment system.

Prevention of Significant Deterioration Area. A requirement of the Clean Air Act that limits the increases in ambient air pollutant concentrations in attainment areas to certain increments, even though ambient air quality standards are met.

Prime farmland. Agricultural lands protected from conversion by the U.S. Department of Agriculture due to their optimal physical and chemical characteristics for production of crops.

Pulpwood. The wood of spruce, pine, aspen, and other trees used to make paper.

Radon. A naturally occurring, colorless, and odorless radioactive gas that is produced by radioactive decay of naturally occurring uranium.

Rare/protected species. A species that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens.

Regeneration. The renewal of a tree crop by natural or artificial means; the actual seedlings and saplings existing in a stand.

Remediation. The process of removing or detoxifying environmental contamination.

Riparian. Of or on the bank of a natural course of water.

Rotation. The planned number of years between the formation of a generation of trees and their harvest at a specified stage of maturity.

Scarification. Loosening or exposing topsoil by mechanical means or by controlled fire in open areas to prepare for regeneration by direct seeding or natural seed fall.

Secondary employment. Additional employment generated in the region of influence by direct worker's spending of payrolls, and purchase of goods and services in the region by the reuse activities.

Sedimentary rock. Rock that is formed from deposits of pre-existing rocks, from deposits of the hard parts of organisms, or from salts deposited from solution.

Seismic Zone O. Area designated in the Uniform Building Code as having a very low potential risk for large seismic events.

Seismicity. Relative frequency and distribution of earthquakes.

Shelterwood system. A harvest method used in even-aged management involving removal of a stand of trees through a series of cuttings designed to establish a new crop, with seed and protection provided by a portion of the stands.

Shrink/swell potential. Volume change in soils possible upon wetting or drying.

Silvics. The natural science which deals with the laws underlying the growth and development of single trees and of the forest as a biological unit.

Silviculture. The theory and practice of controlling the establishment, composition, constitution, and growth of forests.

Site. As it relates to cultural resources, any location where humans have altered the terrain or discarded artifacts.

Skidder. A forest tractor which carries the wood load partly on the machine and the rest is skidded along the ground.

Skidding. Transporting trees or tree parts entirely off the ground by a terrain transport vehicle.

Slash. The residue left on the ground after felling, or accumulating there as a result of storm, fire, girdling, or poisoning.

Sludge. A heavy, slimy deposit, sediment, or mass resulting from industrial activity; solids removed from wastewater.

Snag. A standing dead tree used by birds for nesting, roosting, perching, courting, and/or foraging for food and by many mammals for denning and foraging for food.

Softwoods. A term for both the timber and the trees belonging to the group Gymnospermae.

Solid waste management unit (SWMU). Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released.

Species of special concern. Defined by the Michigan Natural Features Inventory as a species that is rare and may become endangered or threatened in the future.

Stand. Referring to a stand of trees which is an aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition to be distinguishable from the forest on adjoining areas.

State Historic Preservation Officer (SHPO). The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

Sulfur dioxide (SO₂). A toxic gas that is produced when fossil fuels, such as coal and oil, are burned. SO₂ is the main pollutant involved in the formation of acid rain. SO₂ also can irritate the upper respiratory tract and cause lung damage. During 1980, some 27 million tons of SO₂ were emitted in the United States, according to the Office of Technology Assessment. The major source of SO₂ in the United States is coal-burning electric utilities.

Surplus property. Property designated as excess that is of no interest to any federal agency. These properties are made available to state, local, or nonprofit organizations or sold to private organizations.

Thermal cover. A condition where a dense vegetation conserves the amount of heat in an area.

Thinning. Cutting made in an immature crop or stand, primarily to accelerate the diameter increment (annual growth) of the residual trees, but also by suitable selection to improve the average form of the trees that remain.

Threatened species. Plant and wildlife species likely to become endangered in the foreseeable future.

Total suspended particulates (TSP). The particulate matter in the ambient air. The previous NAAQS for particulates was based on TSP levels; it was replaced in 1987 by an ambient standard based on PM₁₀ levels.

Transfer. Deliver U.S. government property accountability to another federal agency.

Transition area. Controlled airspace extending 700 feet or more upward from the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace.

Understory. A layer of vegetation growing near the ground and beneath the canopy of a taller layer.

Uneven-aged. A forest stand composed of intermingling trees that differ markedly in age, usually by more than 10 to 20 years.

Unique farmland. Agricultural lands protected from conversion by the U.S. Department of Agriculture due to their value for production of specific or high economic value crops.

U.S. Environmental Protection Agency (U.S. EPA). The independent federal agency, established in 1970, that regulates federal environmental matters and oversees the implementation of federal environmental laws.

Utility systems. For purposes of this document, utility systems consist of water supply and distribution, wastewater collection and treatment, solid waste collection and disposal, and energy supply and distribution.

Visual flight rules. Rules that govern the procedures for conducting flight under visual conditions.

Volatile organic compounds (VOCs). Compounds containing carbon, excluding CO, CO₂, carbonic acid, metallic carbides, metallic carbonates, and ammonium carbonate.

Water Resources. Includes underground and surface sources of water for the area, and the quality of that water.

Wetlands. Areas that are inundated or saturated with surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil. This classification includes swamps, marshes, bogs, and similar areas. Jurisdictional wetlands are those wetlands that meet the hydrophytic vegetation, hydric soils, and wetland hydrology criteria under normal circumstances (or meet the special circumstances as described in the U.S. Army Corps of Engineers, 1987, wetland delineation manual where one or more of these criteria may be absent and are a subset of "waters of the United States").

Zoning. The division of a municipality (or county) into districts for the purpose of regulating land use, types of building, required yards, necessary off-street parking, and other prerequisites to development. Zones are generally shown on a map and the text of the zoning ordinance specifies requirements for each zoning category.

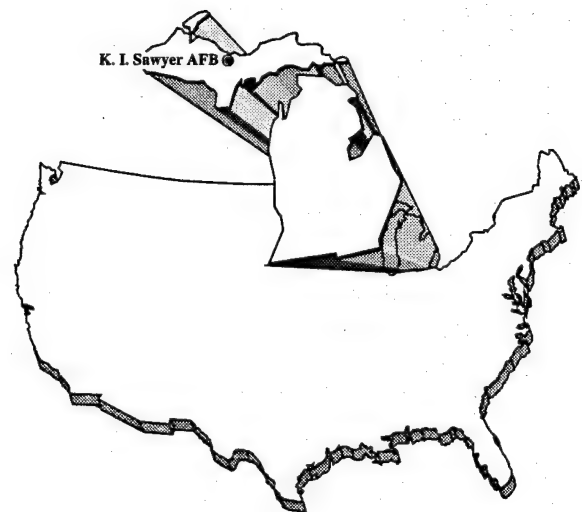
ACRONYMS/ABBREVIATIONS

AADT	average annual daily traffic
ACC	Air Combat Command
ACM	asbestos-containing material
ADT	average daily traffic
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFI	Air Force Instruction
AGE	aerospace ground equipment
ASHERA	Asbestos Hazard Emergency Response Act
AICUZ	Air Installation Compatible Use Zone
ALP	Airport Layout Plan
AOC	Area of Concern
APE	Area of Potential Effect
APZ	Accident Potential Zone
ARTCC	Air Route Traffic Control Center
ATC	air traffic control
BACT	best available control technology
BCT	Base Realignment and Closure (BRAC) Cleanup Team
BMP	best management practice
BNA	block numbering areas
BRAC	Base Realignment and Closure
CAA	Clean Air Act (federal)
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Commercial Forest Act (Michigan)
CFR	Code of Federal Regulations
CO	carbon monoxide
CO ₂	carbon dioxide
COCESS	Contract Operated Civil Engineering Supply System
COE	U.S. Army Corps of Engineers
CPSC	Consumer Product Safety Commission
CR	County Road
°F	degrees Fahrenheit
dB	decibel
DBCRA	Defense Base Closure and Realignment Act
DEIS	Draft Environmental Impact Statement
DERP	Defense Environmental Restoration Program
DLA	Defense Logistics Agency
DNL	day-night average sound level
DOI	Department of the Interior

DOD	Department of Defense
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
EDMS	Emission and Dispersion Modeling System
EGADS	U.S. EPA Graphical Aerometric Data System
EIAP	environmental impact analysis process
EIS	Environmental Impact Statement
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FAA	Federal Aviation Administration
FBO	Fixed Base Operator
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPMR	Federal Property Management Regulations
FS	feasibility study
GSA	General Services Administration
HABS/HAER	Historic American Buildings Survey/Historic American Engineering Record
HAP	hazardous air pollutant
HARM	Hazard Assessment Ranking Methodology
HMTA	Hazardous Materials Transportation Act
HHS	Department of Health and Human Services
HUD	U.S. Department of Housing and Urban Development
IFR	instrument flight rules
ILS	Instrument Landing System
INM	Integrated Noise Model
IRP	Installation Restoration Program
kVA	kilovolt ampere
L_{dn}	day-night average sound level (DNL)
L_{eq}	equivalent sound level
LOS	Level of Service
LRA	Local Redevelopment Authority
MACT	maximum achievable control technology
MANG	Michigan Army National Guard
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDEQ-AQD	Michigan Department of Environmental Quality - Air Quality Division
MERA	Michigan Environmental Response Act
MGD	million gallons per day
mg/l	milligrams per liter
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
mm	millimeter
MMCF	million cubic feet

MOA	military operations area
MSDS	Material Safety Data Sheet
MSL	mean sea level
MTR	military training route
MWH	megawatt-hours
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NCO	Noncommissioned Officer
NDI	Non-Destructive Inspection
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFADD	No Further Action Decision Document
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
nm	nautical mile
NO	nitric oxide
NO ₂	nitrogen dioxide
N ₂ O	nitrous oxide
NOI	Notice of Intent
NO _x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRHP	National Register of Historic Places
O ₃	ozone
OL	Operating Location
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Preliminary Assessment
PAPI	Precision Approach Path Indicator
PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
pCi/l	picocuries per liter
PHV	peak-hour volume
P.L.	Public Law
PM ₁₀	particulate matter equal to or less than 10 microns in diameter
POL	petroleum, oil, and lubricants
ppm	parts per million
PR/VS	Preliminary Review/Visual Site Inspection
PSD	Prevention of Significant Deterioration
RA	Remedial Action
RAB	Restoration Advisory Board
RAMP	Radon Assessment and Mitigation Program

RAPCON	radar approach control
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROI	Region of Influence
RPZ	runway protection zone
SAC	Strategic Air Command
SARA	Superfund Amendments and Reauthorization Act
SEL	sound exposure level
SH	State Highway
SHPO	State Historic Preservation Officer
SI	site inspection
SO ₂	sulfur dioxide
SWMU	solid waste management unit
TCE	trichloroethylene
TD	Technology Development
TRACON	terminal radar approach control
TSCA	Toxic Substances Control Act
TSD	treatment, storage, or disposal
TSP	total suspended particulates
UPPCO	Upper Peninsula Power Company
U.S. #	U.S. Highway
U.S.C.	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
VAQ	Visiting Airmen's Quarters
VFR	visual flight rules
VOC	volatile organic compound
VOQ	Visiting Officers' Quarters
VOR	very high-frequency omnidirectional range
VORTAC	very high-frequency omnidirectional range tactical air navigation
VPH	vehicles per hour
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
WS	Wisconsin Statutes
WWTP	wastewater treatment plant



APPENDIX B

APPENDIX B
NOTICE OF INTENT

APPENDIX B

NOTICE OF INTENT

The following Notice of Intent was circulated and published by the Air Force in the October 28, 1993, Federal Register in order to provide public notice of the Air Force's intent to prepare an Environmental Impact Statement of disposal and reuse of K. I. Sawyer Air Force Base, Michigan. This Notice of Intent has been retyped for clarity and legibility.

Please note: The point of contact for information on the disposal and reuse environmental impact statement has been changed. The new point of contact is:

William A. Myers, AICP
HQ AFCEE/ECP
3207 North Road
Brooks AFB, Texas 78235-5363
(210) 536-3668

**NOTICE OF INTENT
TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT
FOR DISPOSAL AND REUSE OF SEVEN AIR FORCE BASES**

The United States Air Force (Air Force) is issuing this notice to advise the public that the Air Force intends to prepare seven environmental impact statements (EISs) to assess the potential environmental impacts of disposal and reuse of the following bases identified for closure by Congress:

Gentile Air Force Station, Dayton, Ohio

Griffiss Air Force Base, Rome, New York

March Air Force Base, Riverside, California

Newark Air Force Base, Newark, Ohio

K. I. Sawyer Air Force Base, Marquette, Michigan

O'Hare International Airport Air Force Reserve Station, Chicago, Illinois

Plattsburgh Air Force Base, Plattsburgh, New York

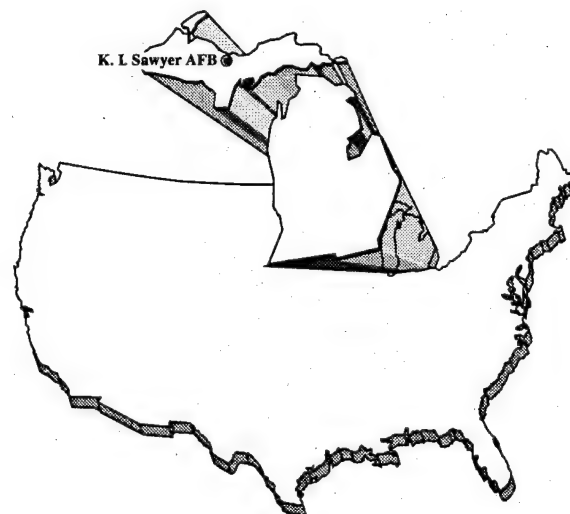
These EISs will address the potential environmental impacts of disposal of the property to public or private entities, as well as the potential environmental impacts of all reasonable reuse alternatives.

To provide a forum for public officials and the community to provide information and comments, scoping meetings will be held in each community beginning in November 1993 and continuing through late 1994. Notice of the times and locations of these meetings will be provided at a later date, and publicized in each community and in the Federal Register. The purpose of these meetings is to: (1) identify the environmental issues and concerns that should be analyzed to support base disposal and reuse; (2) solicit comments on the proposed action; and (3) solicit potential disposal and reuse alternatives for consideration in developing each EIS. In soliciting disposal and reuse alternatives, the Air Force will consider all reasonable alternatives offered by any federal, state or local government agency, and any federally-sponsored or private entity or individual. The resulting EISs will be considered in making disposal decisions that will be documented in the Air Force's Final Disposal Plan and Record of Decision for each base.

To ensure sufficient time to adequately consider public comments concerning environmental issues and disposal alternatives to be included in the EISs, the Air Force recommends that comments and reuse proposals be presented at the upcoming scoping meetings or forwarded to the address listed below at the earliest possible date. The Air Force will, however, accept additional comments at any time during the environmental impact analysis process.

Please direct written comments or requests for further information concerning the base disposal and reuse EISs to:

Lt. Colonel Gary P. Baumgartel
AFCEE/ESE
8106 Chennault Road
Brooks AFB, Texas 78235-5318
(210) 536-3869



APPENDIX C

APPENDIX C
FINAL ENVIRONMENTAL IMPACT STATEMENT MAILING LIST

APPENDIX C
FINAL ENVIRONMENTAL IMPACT STATEMENT
MAILING LIST

This list of recipients includes interested federal, state, and local agencies and individuals who have expressed an interest in receiving the document. This list also includes the governor of Michigan, as well as United States senators and representatives and state legislators.

ELECTED OFFICIALS

Federal Officials

U.S. Senate

The Honorable Carl Levin
The Honorable Donald Riegle

U.S. House of Representatives

The Honorable Bart Stupak

State of Michigan Officials

Governor

The Honorable John Engler

State Legislature

The Honorable Dominic Jacobetti
The Honorable Don Koivisto

Regional/Local Officials

The Honorable Scott Pinkard
Mayor of Marquette

The Honorable Charles Vader
Mayor of Escanaba

GOVERNMENT AGENCIES

Federal Agencies

Administrative Services and Property Management
Office of the Secretary of Transportation

Advisory Council on Historic Preservation

Federal Agencies (Continued)

Bureau of Mines

Bureau of Prisons
Chief, Facilities Development and Operations

Center for Environmental Health and Injury Control
Special Programs Group (F29)

Council of Economic Advisors
Defense Technical Information Center

Department of Agriculture
Forest Service

Department of Commerce
Director, Economic Adjustment Division

Department of Commerce
Director, Office of Intergovernmental Affairs

Department of Education
Assistant to the Deputy Under Secretary for Intergovernmental and Interagency
Affairs

Department of Energy
Division of Intergovernmental Affairs (CP-23)

Department of Health and Human Services
Office of Human Development Services

Department of Housing and Urban Development
Director, Community Management Division (CPD)

Department of the Interior
Director, Office of Environmental Affairs

Department of the Interior
National Parks Service

Department of the Interior
U.S. Fish and Wildlife Service

Department of Labor
Intergovernmental Affairs

Department of Transportation
Bureau of Aeronautics

Department of Veterans Affairs

Federal Agencies (Continued)

Environmental Protection Agency, Headquarters
Director, Office of Federal Activities

Farmers Home Administration
Deputy Administrator for Program Operations

Federal Aviation Administration
Director, Office of Environment and Energy

Federal Emergency Management Agency

General Services Administration
Assistant Commissioner for Real Estate Policy and Sales

Small Business Administration
Director, Office of Procurement

U.S. Army Corps of Engineers

Department of Defense

Department of Defense
Director, Office of Economic Adjustment

U.S. Air Force
Programs and Legislation Division

Regional Offices of Federal Agencies

Department of Agriculture
Huron National Forest
Forest Supervisor, Planning Group

Department of Housing and Urban Development
Director

Department of the Interior
U.S. Fish and Wildlife Service

Department of Transportation
Bureau of Aeronautics

Environmental Protection Agency, Region V
Chief, Planning and Environmental Review Branch

Federal Aviation Administration
Airports District Office
Belleville, Michigan

Regional Offices of Federal Agencies (Continued)

Federal Aviation Administration
Airports District Office
Des Plaines, Illinois

Federal Aviation Administration
Air Route Traffic Control Center (ARTCC)
Manager

Federal Emergency Management Agency
Region V

General Services Administration
Office of Real Estate Sales

State of Michigan Agencies

Agricultural Department
Director

Bureau of History
State Historic Preservation Office

Central Upper Peninsula Planning and Development
Director

Corrections Department
Director

Department of Commerce
Director

Department of Labor
Director

Department of Natural Resources
Director

Department of Natural Resources
Forest Management Division

Department of Natural Resources/Environmental Quality
Region 11 Headquarters

Department of Public Health
Director

Department of Transportation
Director

State of Michigan Agencies (Continued)

Education Board
Director

Employment Security Commission
Director

Housing Development Authority
Director

K. I. Sawyer Base Conversion Authority
Chairperson

K. I. Sawyer Base Conversion Coordinator

Michigan Office of Federal Grants
Director

Office of Economic Development
Director

Social Services Department
Director

State Department
Secretary of State

State Policy Director and Counsel to the Cabinet

Water Resources Commission
Director

Local Government Agencies

Delta County Board of Commissioners
Chairman

Forsyth Township
Supervisor

Marquette County Board of Commissioners

Marquette County RMDD
Mr. Jim Kippola

Marquette Township
Supervisor

Negaunee Township
Supervisor

Local Government Agencies (Continued)

Sands Township
Supervisor

West Branch Township
Supervisor

Libraries

Escanaba Public Library

Forsyth Township Public Library

Ishpeming Carnegie Library

Marquette Public Library

Negaunee Public Library

Northern Michigan University, Lydia M. Olson Library

OTHERS

Other Organizations/Individuals

David P. Agee

Richard Aho

Bay Mills Executive Council

Harry A. Bryson

Delta County Chamber of Commerce

Philip A. Doepke

The Environmental Company, Inc.
Ms. Anne Tate

Environmental Defense Fund
Executive Director

Environmental Policy Center/Institute

Friends of the Earth

William H. Gray

Greater Ishpeming Chamber of Commerce

Other Organization/Individuals (Continued)

Great Lakes Mid-Atlantic Hazardous Substance Research Center
Dr. Walter J. Weber, Jr., Center Director

Great Lakes United, Region II
Mr. John Witzke
Regional Director

Scott R. Gygi

Hannahville Indian Community Council

Keweenaw Bay Tribal Council

Lac Vieux Desert Band of Lake Superior
Chippewa Indians of Michigan

Ronald Larson

Marquette Area Chamber of Commerce

Marquette County Airport

Marquette County Solid Waste Management Authority

John G. Meier

Michigan Air Force Association
Mr. William Stone, President

Michigan United Conservation Clubs, Inc.

Military Affairs Committee
Mr. Bruce Myles

National Audubon Society

National Audubon Society
Great Lakes Region

National Wildlife Federation

National Wildlife Federation, Region 7

Natural Resources Defense Council

The Nature Conservancy

The Nature Conservancy
East Lansing

Other Organization/Individuals (Continued)

Leland N. Nellist, Sr.

The Pathfinders

Sault Ste. Marie Chippewa Tribal Council

Sierra Club

Sierra Club
Midwest Field Office

Tetra Tech, Inc.

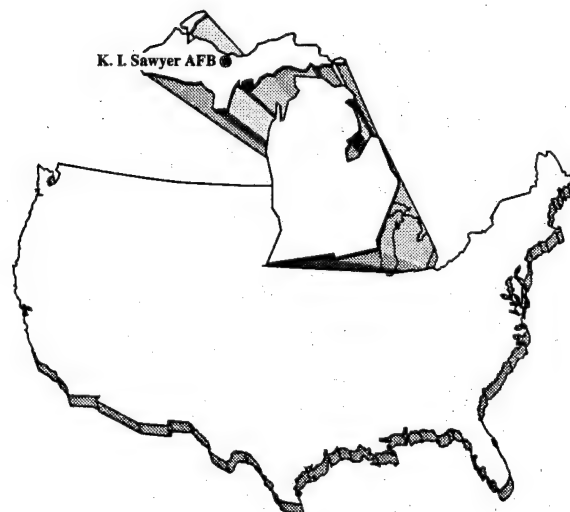
Upper Peninsula Environmental Coalition

Steven W. White

The Wilderness Society

The Wildlife Society
North Central Section

World Wildlife Fund



APPENDIX D

APPENDIX D

K. I. SAWYER AIR FORCE BASE INSTALLATION RESTORATION PROGRAM BIBLIOGRAPHY AND SITE DESCRIPTIONS

K. I. SAWYER AFB INSTALLATION RESTORATION PROGRAM (IRP) BIBLIOGRAPHY

- Department of Defense, 1994. BRAC Cleanup Plan (BCP) K. I. Sawyer AFB, Marquette, Michigan.
- EG & G Idaho, 1991. Pilot-Scale Free Product Recovery Study, K. I. Sawyer Air Force Base, Marquette, Michigan, September.
- Engineering-Science, Inc., 1985. Installation Restoration Program Phase I Records Search, K. I. Sawyer AFB, Michigan, Prepared for the U.S. Air Force.
- Engineering-Science, Inc., 1992. Bioventing Pilot Test Work Plan for IRP Site ST-04 POL Bulk Fuel Storage Area, K. I. Sawyer AFB, Michigan, Prepared for the U.S. Air Force.
- U.S. Air Force, 1991a. Decision Document for Construction and Installation of a Groundwater Treatment System, November.
- U.S. Air Force, 1991b. Decision Document, Sites DP-01 and SS-05, Drainage Pit No. 1 and Defense Reutilization and Marketing Office, August.
- U.S. Air Force, 1991c. Decision Paper Sites OT-14 and OT-15, Hazardous Waste Storage Buildings 744 and 707, September.
- U.S. Air Force, 1993. Community Relations Plan, K. I. Sawyer Air Force Base, Marquette Michigan, April.
- U.S. Geological Survey, 1987. Installation Restoration Program Phase II Confirmation/Quantification Stage I, Prepared for the U.S. Air Force.
- Woodward-Clyde, 1992. Remedial Investigation/Feasibility Study OU-LF1, OU-LF2, OU-LF3, OU-LF4, and OU-HA2, K. I. Sawyer AFB, Michigan, U.S. Army Corps of Engineers, Omaha District, September.

INSTALLATION RESTORATION PROGRAM SITE DESCRIPTIONS

DRAINAGE POND NO. 1

Drainage Pond No. 1 (Site DP-01) is in the southern portion of the base immediately west of the Petroleum, Oil, and Lubricant (POL) Storage Area and east of Building 414. The site consists of an unlined infiltration basin approximately 4 feet wide, 15 feet long, and 2 feet deep that may have received shop wastes directly from Building 414, which was used as a jet engine test cell from the late 1950s to 1971, or through an oil/water separator connected to the floor drain of the building. The shop wastes may have included paints, solvents, and jet engine fuel.

Site DP-01 was identified during the 1985 Phase I - Records Search. During a site visit a black residue, possibly oil and fuel, was identified. Based on the presence of this residue, the highly permeable nature of the soils, and the close proximity to surface waters, the site received a Hazard Assessment Rating Methodology (HARM) score of 53. The site was then recommended for soil sampling as part of Phase II investigations.

Phase II, Stage 1 investigations were initiated in 1986 by the United States Geological Survey (USGS). Soil samples taken were analyzed for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH). Only tetrachloroethylene was detected. Surface soils were later excavated; clean fill dirt was added and the area was revegetated.

A No Further Action Decision Document (NFADD) was submitted to Headquarters Strategic Air Command (HQ SAC) in August 1991. However, the site was reopened because the potential for groundwater contamination from Site DP-01 was not evaluated during previous studies. Since groundwater flows southeast from Site DP-01 to the adjacent POL Storage Area (Site ST-04), it is believed that any groundwater contamination from Site DP-01 would be masked by the POL-related contamination from Site ST-04; therefore, Site DP-01 was added to Operable Unit 1 (OU-1) in 1991. The extent of contamination, the risks to human health and the environment, and the final remedial actions will be determined by a Remedial Investigation (RI) (September 1994) and by a subsequent Feasibility Study (FS), which are under way and scheduled for completion in March 1995. This site was identified as Solid Waste Management Unit (SWMU) 13 during a Preliminary Review/Visual Site Inspection conducted in 1992 by the U.S. Environmental Protection Agency (EPA).

DRAINAGE POND NO. 2

Drainage Pond No. 2 (Site DP-02) is in the central part of the base, near the intersection of Avenue A-A and Fifth Street. The site consists of an unlined,

man-made infiltration basin, which covers approximately 1 acre. Site DP-02 was originally used as the outfall for storm drainage on base, receiving contaminated storm runoff from the Former Engine Repair Shop (Building 725) approximately 2,400 feet to the northwest, the flightline area, and other industrial facilities. From the early 1960s to 1976, wastes generated during routine engine maintenance at the Former Engine Repair Shop were discharged to floor drains that were connected to the base storm sewer system and ultimately to Site DP-02.

In the early 1980s, elevated levels of trichloroethylene (TCE) were detected in a proposed base drinking water supply well, east of the base hospital. As a result, this site was investigated during the 1985 Phase I - Records Search as a possible contamination source. Due to the quantities of industrial wastes discharged to the pond and the TCE detected in the groundwater, the site received a HARM score of 75. Installation of groundwater monitoring wells and pond sediment sampling were recommended as part of Phase II investigations.

Due to Phase II investigations initiated in 1986 and subsequent IRP investigations, over 150 groundwater observation wells have been installed in the central part of the base to characterize the extent of TCE in groundwater. A TCE plume, underlying an area of about 270 acres from the Former Engine Repair Shop southeastward to Silver Lead Creek, has been delineated. Site DP-02 is believed to be a source of this contamination and was placed in the Central Base TCE and Benzene Contamination Groundwater OU (OU-2). Other sites within OU-2 include SS-17, ST-18, and ST-19. Groundwater flow in the central portion of the base is in an east/southeast direction toward Silver Lead Creek. Concentrations of TCE in the plume range from about 1,800 micrograms per liter ($\mu\text{g/l}$) between Avenue B and the Former Engine Repair Shop in the northwest, to less than 2 $\mu\text{g/l}$ in the southeast portion of the plume. The U.S. EPA maximum contaminant level (MCL) for TCE in drinking water is 5 $\mu\text{g/l}$. As an interim remedial action (IRA), a groundwater pump-and-treat system was installed in 1993 in the central portion of the base along Fifth Street; it became operational in June 1994. The effectiveness of the system to remove contamination from the groundwater will be evaluated to determine if the system should remain in place and/or be expanded to meet remediation goals. This site was identified as SWMU 14 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

DRAINAGE POND NO. 3

Drainage Pond No. 3 (Site DP-03) is in the northern part of the main cantonment area of the base, near the intersection of Avenue G and Eleventh Avenue. The site consists of a low-lying swampy and vegetated area approximately one-half acre in size. From 1957 to 1985, the pond received runoff from flightline facilities including Building 740 which was an

equipment maintenance wash rack. Waste streams may have included ethylene glycol (antifreeze), POL, fuels, and cleaning compounds. Currently, wastes from this building are recycled or disposed of off site. Specific information regarding waste disposal practices before 1982 is unavailable.

Site DP-03 was identified during the 1985 Phase I - Records Search. The site received a HARM score of 64, due to the quantity and unknown nature of the runoff it received, the high permeability of the soils, and the site's proximity to surface water. Installation and sampling of groundwater monitoring wells were recommended as part of Phase II investigations.

Site DP-03 was not included in the Phase II, Stage 1 hydrologic investigations conducted in 1986 and 1987. However, during Phase II, Stage 2, the USGS installed three groundwater monitoring wells near the site. Groundwater was analyzed for aromatic and halogenated VOCs, and phenols. Trace concentrations of phenol, 1,2-dichloroethane, and tetrachloroethylene (less than 1 $\mu\text{g/l}$ each) were detected in the upgradient as well as downgradient wells. No on-site soil or surface water investigations were performed.

Additional characterization and investigation of Site DP-03 was performed during fiscal year (FY) 1993. The extent of contamination and the risks to human health and the environment have been detailed in a draft RI/FS. The final remedial action was conducted in summer 1994 and the top 3 feet of soil was removed and disposed of at Landfill No. 4 (Site LF-11). An NFADD has been submitted to the regulators; additional groundwater sampling will be conducted during summer 1995 prior to site close-out. This site was identified as SWMU 15 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

PETROLEUM, OIL, AND LUBRICANTS STORAGE AREA

The POL Storage Area (Site ST-04), in the southern part of the base adjacent to Avenue D, has been operating since the late 1950s. The site consists of five aboveground steel bulk storage tanks; each tank is surrounded by a concrete-lined earthen berm containment area. Three tanks contain jet propulsion fuel (JP-4), which is received via pipeline; one tank contains deicing fluid; and one tank is empty. Since 1970, five documented spills of JP-4 have occurred at Site ST-04. It is estimated that a total of 65,000 to 74,000 gallons of fuel have been spilled at the site since 1970, resulting in soil and groundwater contamination. Spills before 1970 were not documented.

Site ST-04 was identified during the 1985 Phase I - Records Search. Due to the quantities and number of known releases on site, the high permeability of the soils, and close proximity of groundwater, the site received a HARM score of 75. Installation of groundwater monitoring wells to better define

the extent of contamination was recommended as part of Phase II investigations.

Extensive soil and groundwater sampling was performed between 1987 and 1990 as part of the USGS Phase II, Stage 1 and Stage 2 groundwater characterization investigations. Twenty-four soil borings were sampled at three depths and analyzed for aromatic VOCs and TPH. Benzene, toluene, and xylenes were detected at concentrations above action levels, as was TPH. A soil gas survey was conducted to determine the optimal locations for groundwater monitoring wells at Site ST-04.

In 1987, 64 groundwater monitoring wells were installed in the local aquifer to determine the extent of groundwater contamination at Site ST-04 and define the extent of free product present on the water table. Groundwater in this portion of the base flows in a southeast direction. Groundwater samples collected from 1988 to 1990 contained high concentrations of benzene, toluene, and xylenes.

Free product (JP-4) was observed in approximately 20 wells that define a plume originating from the southeast corner of Site ST-04. The plume appears to be migrating southeastward toward Silver Lead Creek. Free product thickness in the wells varied from a thin film of hydrocarbon to 2.4 feet. (Note: The thickness of product in wells varies substantially from actual thickness of product on the water table. A thickness of 2.5 feet in a well may represent a thickness of approximately 6 inches on the water table.)

As a result of groundwater level measurements and surface water sample results, contaminated groundwater has been found to be flowing to Silver Lead Creek. Additionally, based on the results of previous investigations, benzene has been detected in Silver Lead Creek downstream from where the plume discharges at levels ranging from non-detect to 7.5 parts per billion.

From November 1990 to January 1991, a pilot-scale study/IRA was conducted at Site ST-04. This study evaluated the effectiveness of two systems to recover floating hydrocarbons from the groundwater surface. Over 275 gallons of JP-4 were recovered during this study.

Site ST-04 is part of OU-1, which was established in 1991 and includes sites DP-01 and SS-05. A pilot-scale study on soil remediation by bioventing is under way at Site ST-04. Site closeout will not take place until an RI/FS, which began in spring 1994, has been performed. The anticipated final remedial action plan is a combination of bioventing, a passive pumping system to remove fuel from the water table, and a pump-and-treat system to remove/treat contaminated groundwater. Provided funding is available, all systems are scheduled to be in place in 1997. This site was identified as

SWMU 4 during the U.S. EPA Preliminary Review/Visual Site Inspection conducted in 1992.

A JP-4 free product removal system was placed in operation in summer 1994. JP-4-contaminated water is skimmed from the water table, run through an oil/water separator and a carbon filtering system, and discharged to the sanitary sewer system for additional treatment.

DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) STORAGE YARD

The Defense Reutilization and Marketing Office (DRMO) Storage Yard (Site SS-05) is in the southern portion of the base, east of Site ST-04. The site consists of a flat, asphalt-covered, open storage area approximately 325 feet long and 205 feet wide. The area has been used as a hazardous waste storage area since 1980. Prior to 1980, waste oil was stored in a sandy area of the yard. As many as 60 drums were stored in this location on some occasions, and many may have leaked. Polychlorinated biphenyl (PCB)-containing transformers were also stored in the area prior to final disposal. Area runoff flows off site to the surrounding grass area.

This site was identified during the 1985 Phase I - Records Search. Because of the highly permeable soils on site, the surface water flow toward Silver Lead Creek, and the possible on-site contamination due to the release of hazardous wastes, the site received a HARM score of 50. Soil sampling was recommended as part of Phase II investigations.

In 1986, several groundwater monitoring wells were installed by the USGS in the vicinity of Site SS-05 during the Phase II, Stage 1 investigations. In 1987, soil samples were analyzed for organochloride pesticides/PCBs, oil, and grease. No surface soil samples were taken. During these investigations, the only constituents detected in the soil samples were oil and grease. None of the other analytes were detected.

A decision document was submitted to HQ SAC in August 1991 recommending no further action for Site SS-05. However, since the groundwater at this site is contaminated with POL, the site has been reopened. Site SS-05 was included as part of the POL Storage Area OU (OU-1), and all future investigations or remedial actions for the site will be in conjunction with Site ST-04 activities as part of OU-1. An RI/FS for OU-1 was conducted in 1994. This site has been identified as SWMU 3 following a Preliminary Review/Visual Site Inspection conducted by the U.S. EPA in 1992.

FIRE TRAINING AREA NO. 1

Fire Training Area No. 1 (Site FT-06) is near the northern end of the primary taxiway in the northern part of the base. The site consisted of an unlined

pit of unknown size that was used for fire fighting training exercises from approximately 1958 to the early 1970s. During training exercises, 55-gallon drums of waste fuel, POL, paints, thinners, degreasers, and hydraulic fluids (stored adjacent to the site) were emptied onto the soil and ignited. Training fires were extinguished with water, protein foam, and carbon dioxide. Exercises were conducted approximately four times per month, using an estimated 300 to 2,000 gallons of waste per exercise. Pre-wetting of the soil was not a routine practice, and no attempt was made to collect unburned fuel or separate the wastes from water after the training exercises.

This site was identified during the 1985 Phase I - Records Search. Due to the quantities of known wastes burned on site, the highly permeable soils, and the site's proximity to Big Creek, the site received a HARM score of 60. Installation of groundwater monitoring wells and soil sampling were recommended as part of Phase II investigations to determine the extent of contamination.

In 1988, three groundwater monitoring wells were installed in the aquifer beneath Site FT-06 as part of USGS Phase II, Stage 1 hydrologic investigations; three additional wells were installed in 1990. Groundwater samples were analyzed for aromatic and halogenated VOCs, lead, and TPH. A trace amount of lead was detected in one sample and a concentration of 210 milligrams per liter (mg/l) of TPH was detected in one sample. All TCE levels detected during both rounds of sampling were below action levels. Trace amounts of 1,1,1-trichloromethane were detected in two 1988 samples and all three 1990 samples. Benzene was not detected in 1988; however, two 1990 samples contained benzene above action levels. Groundwater in this area flows in an eastward direction toward the base boundary.

Soil samples were also collected during well installation. Two samples contained elevated concentrations of ethylbenzene, toluene, and xylenes.

In 1993, a pilot-scale bioventing system for removal of organics was installed as an IRA. This removal action was implemented to determine system effectiveness.

The final remedial action selected for this site will depend on the results of an RI (September 1994) and an FS scheduled for completion in 1995. This site was identified as SWMU 6 during the Preliminary Review/Visual Site Inspection conducted in 1992 by U.S. EPA.

FIRE TRAINING AREA NO. 2

Fire Training Area No. 2 (Site FT-07) is in the northeastern part of the base immediately north of the new control tower (Building 747), east of the primary taxiway. The site consists of an octagonal concrete pad

approximately 75 feet wide bordered by a 6-inch high concrete berm. From the early 1970s until 1990 this area was used for approximately three to four training exercises per month; an estimated 300 to 500 gallons of pure JP-4 were used as the ignition source during each exercise. Fires were extinguished with protein foam, carbon dioxide, aqueous film-forming foam, chlorobromomethane, and water. Until 1982, there was no pre-wetting of the site and no unburned fuel recovery. In 1982, a concrete pad was constructed and a fuel-water drain system was installed to drain any liquids remaining on the pad to an oil/water separator. The fuel collected was then burned off and the remaining water was discharged to a nearby underground leach bed.

This site was identified during the 1985 Phase I - Records Search. The site received a HARM score of 55 due to the quantities of waste discharged to the site, the duration of fire training exercises, and the permeability of the soil. Soil sampling and the installation and sampling of groundwater monitoring wells were recommended as part of Phase II investigations to define the extent of contamination.

Samples taken in 1988 from three groundwater monitoring wells installed into the aquifer beneath Site FT-07 were analyzed for organic compounds. Benzene, toluene, and TCE were detected in concentrations above action levels. Samples from eight additional wells, which were installed in 1989 downgradient from Site FT-07, contained concentrations of organic compounds believed to be a result of fuel contamination. Chemical analyses of groundwater samples from 1988, 1989, and 1990 suggest that these concentrations are decreasing.

In August 1991, a leaking underground storage tank (UST) and associated plumbing were removed from the site and approximately 500 cubic yards of petroleum-contaminated soil were removed. Contamination at Site FT-07 is believed to be the combined result of discharges from the leaking UST and fire training exercises.

In 1993, a pilot-scale bioventing system for removal of organics was installed as an IRA. This removal action was implemented to determine system effectiveness. The final remedial action selected will depend on the results of an RI (September 1994) and an FS currently scheduled for 1995. This site was identified as SWMU 7 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

LANDFILL NO. 1

Landfill No. 1 (Site LF-08) is in the southern portion of the base, immediately south of the weapons storage area. The site consists of an approximately 21-acre landfill where construction waste was burned on a daily basis from 1955 to 1957. From 1963 to 1973, the landfill was used to dispose of

wastes such as paints, solvents, acids, fertilizer, asphalt, asbestos, household refuse, fly ash, hardfill, and sludge, which were covered with soil daily. In addition, about 50 drums of dichlorodiphenyl trichloromethane (DDT) may have been disposed of at the site sometime before 1970. The existence or location of the DDT-containing drums could not be verified, although large metal objects were detected at seven locations at the landfill during a ground-penetrating radar survey conducted in October 1989. No DDT has been detected in groundwater downgradient from Site LF-08.

This site was identified during the 1985 Phase I - Records Search. Due to the introduction of liquid wastes in trenches up to 40 feet deep, as well as the high permeability of the soils, a HARM score of 71 was assigned to this site. Installation of groundwater monitoring wells and sampling of surface water and soils were recommended as part of Phase II investigations.

The USGS began the Phase II, Stage 1 hydrologic investigations in 1986, when two groundwater monitoring wells were installed in the aquifer in the vicinity of Site LF-08. Groundwater in this area flows in an east to southeast direction toward Silver Lead Creek and Stump Lake. Samples analyzed for organic compounds were found to contain hydrocarbons and compounds characteristic of fuels in the groundwater.

During the Phase II, Stage 2 investigation conducted in 1988, four additional monitoring wells were installed at Site LF-08. Vinyl chloride was the only constituent detected in the groundwater samples in excess of the U.S. EPA drinking water standard.

Surface water and sediments from Stump Lake and Silver Lead Creek were also sampled and analyzed during the Phase II, Stage 2 investigation. Most analytes were not detected or were below MCLs, except for a single surface water sample from Silver Lead Creek, which had vinyl chloride at a concentration of 2.2 $\mu\text{g/l}$ (the MCL is 2.0 $\mu\text{g/l}$).

Site LF-08 was included in the RI/FS and Baseline Risk Assessment conducted by the U.S. Army Corps of Engineers (COE) in 1992 for the base landfills. Groundwater from one upgradient and seven downgradient wells was sampled and analyzed for VOCs, base neutral/acid extractables (BNAs), pesticides/PCBs, and heavy metals. Results indicated some VOCs and BNAs below action levels were present in the groundwater downgradient of Site LF-08. The groundwater sampling revealed no detectable amounts of vinyl chloride. A total of 17 metals were detected in groundwater upgradient and downgradient of Site LF-08, and concentrations of 14 of these metals increased downgradient of Site LF-08.

Three surface water samples were collected from Silver Lead Creek and Stump Lake, east of Site LF-08, during the RI. The draft RI reported that Stump Lake surface water quality did not appear to be affected by the

landfill. However, surface water was not analyzed for metals during this investigative stage.

A supplemental RI/FS is under way; final remedial actions for LF-08 will be based on the results of the FS scheduled for completion in November 1995. Site LF-08 was identified as SWMU 8 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

LANDFILL NO. 2

Landfill No. 2 (Site LF-09) is in the southern portion of the base, northeast of the intersection of Freedom Boulevard and Scorpion Street. The site consists of a landfill covering approximately 3 acres, which was in operation from 1955 until 1962. Site LF-09 was used for only a short time due to a lack of cover material, as well as its inaccessibility. For the first 2 years of operation, this landfill was used to dispose of hardfill generated during base construction. After 1957, capacitors, household refuse, shop waste, and transformers, along with fly ash from the Central Heating Plant, were discarded at the site. The site is now covered with hardfill, grass, and sand.

Site LF-09 was identified during the 1985 Phase I - Records Search. The site received a HARM score of 67 due to the swampy nature of the area, its proximity to groundwater, and the nature of the wastes disposed of there. Installation of groundwater monitoring wells and sampling of surface water and soils were recommended as part of Phase II investigations.

In 1988, five groundwater monitoring wells were installed at Site LF-09 and one round of sampling was conducted. Phenol was detected above action levels in only one well; none of the other samples had constituents in excess of their MCLs. Groundwater beneath Site LF-09 flows eastward to Silver Lead Creek.

During the Phase II, Stage 2 investigation, three surface water samples were collected from Silver Lead Creek near Site LF-09. Trace amounts of vinyl chloride were detected in all three samples; no other contaminants were detected. The Phase II, Stage 2 report concluded that the vinyl chloride most likely originated from Site LF-08.

Site LF-09 was included in the 1992 RI/FS and Baseline Risk Assessment conducted by the COE for the base landfills. Groundwater from one upgradient well and four wells immediately adjacent to Silver Lead Creek on the downgradient (east) side of the landfill was sampled and analyzed for VOCs, BNAs, pesticides/PCBs, and target analyte list (TAL) metals during the RI. Results indicated the presence of VOCs and metals at concentrations below action levels. Metals were found in the highest concentrations in downgradient monitoring wells that penetrate directly through a portion of the fly ash material disposed of at Site LF-09.

The RI included collection of two downgradient and one upgradient surface water samples from Silver Lead Creek near Site LF-09. These samples were analyzed for VOCs and BNAs; only two BNA analytes were detected.

A supplemental RI/FS is currently under way; final remedial actions for Site LF-09 will be based on the results of the FS scheduled for completion in November 1995. This site was identified as SWMU 9 during a 1992 Preliminary Review/Visual Site Inspection conducted by U.S. EPA.

LANDFILL NO. 3

Landfill No. 3 (Site LF-10) is north of the main industrial area at the northern end of Avenue B. The site consisted of a single east-west oriented trench that was 14 feet wide, 400 feet long, and 30 feet deep. Site LF-10 was used from the early 1970s to 1975, primarily for disposal of household waste, sewage sludge, and small amounts of drummed industrial wastes. The site is now covered with trees approximately 15 to 20 feet tall, making determination of the exact dimensions difficult. It is estimated to cover about 5 acres.

Site LF-10 was identified during the 1985 Phase I - Records Search. It received a HARM score of 75 due to its proximity to groundwater, the permeability of the soils, and the nature and the quantities of the wastes disposed of there. Installation of groundwater monitoring wells and pond sediment sampling were recommended as part of Phase II investigations.

Between 1986 and 1991, groundwater samples from four wells were collected at Site LF-10. Groundwater in this area flows in an east to northeast direction toward the base boundary. Samples collected in 1985 contained trace amounts of organics that were below their respective MCLs for drinking water. In 1988, trace amounts of 1,1,1-trichloromethane were detected in a new monitoring well installed downgradient of Site LF-10. No other analytes were detected.

In 1992, Site LF-10 was investigated as part of the 1992 RI/FS and Baseline Risk Assessment conducted by the COE for the base landfills. During summer 1993, additional downgradient groundwater monitoring wells were installed.

A supplemental RI/FS is under way; final remedial actions for LF-10 will be based upon the results of the FS scheduled for completion in November 1995. Closure plans are expected to include post-closure monitoring and upgraded institutional controls such as fencing, deed restrictions, and warning signs. This site was identified by U.S. EPA as SWMU 10 following a 1992 Preliminary Review/Visual Site Inspection.

LANDFILL NO. 4

Landfill No. 4 (Site LF-11) is in the northern part of the base immediately south of the Explosive Ordnance Disposal range and northwest of Site LF-10. The site covers an area of approximately 40 acres and contains several north-south trending trenches that are 400 feet long, 10 feet wide, and 25 feet deep, in addition to extensive surface debris. Site LF-11 was operated as the principal waste disposal area at the base from 1975 to 1989. Waste discarded at the site were similar to those wastes disposed of at the other base landfills including refuse from base operations and residential housing, and undigested sewage sludge.

This site was identified during the 1985 Phase I - Records Search. Due to the uncertainty behind the types and quantities of the wastes discharged to this site and the permeability of the soils, the site received a HARM score of 54. Installation of groundwater monitoring wells and sampling of surface waters and soils were recommended as part of Phase II investigations.

From 1986 to 1988, the USGS installed and sampled groundwater from several wells in the vicinity of Site LF-11 as part of a hydrogeologic survey. Groundwater samples from the wells at Site LF-11 were analyzed for organic compounds, trace metals, total dissolved solids (TDS), and some inorganic constituents. Fourteen VOCs were detected at low concentrations. Inorganics were detected below action levels, with the exception of TDS, fluoride, and iron at one well. Groundwater beneath Site LF-11 flows in a northeast to east direction toward the base boundary. Surface water and sediment samples from two sites at Big Creek were analyzed for organic and inorganic constituents. No organics were detected, and inorganics were below action levels.

In 1992, Site LF-11 was included in the RI/FS and Baseline Risk Assessment conducted by the COE for the base landfills. During the RI, groundwater from three USGS monitoring wells, two COE wells, and a well previously installed by the Air Force was sampled for target compound list (TCL) VOCs, BNAs, pesticides/PCBs, and TAL metals. Groundwater downgradient of Site LF-11 was found to contain VOCs, BNAs, and heavy metals. The draft RI reported the presence of a contaminant plume in groundwater downgradient of Site LF-11. Surface water samples were collected from three locations adjacent to Big Creek, north of Site LF-11, and were analyzed for TCL, VOCs, and BNAs. The draft RI reported that the surface water quality downgradient of Site LF-11 does not appear to be affected by landfill activities.

A geophysical study was conducted at Site LF-11 prior to landfill capping so that the trench boundaries can be more clearly delineated and capping costs can be minimized.

The RAs selected for cost estimate purposes for Site LF-11 include a landfill cap, regrading, revegetation, and post-closure monitoring. It is anticipated that the capped area will be a minimum of 40 acres. After the remedial measures are in place, Site LF-11 will be closed as an unlicensed municipal landfill. U.S. EPA identified this site as SWMU 11 during a 1992 Preliminary Review/Visual Site Inspection.

HARDFILL AREA NO. 2

Hardfill Area No. 2 (Site LF-12) is in the southwest part of the base, approximately 500 feet north of the Main Gate. The site consists of an area approximately 75 feet by 170 feet that was used for disposal of hardfill and as a storage area for transformers, some of which contained PCBs. The site was in operation from the early 1960s to 1970. The site has now revegetated with small pine trees.

Site LF-12 was identified during the 1985 Phase I - Records Search. Due to the possibility of PCB contamination and the highly permeable nature of the soil, the site received a HARM score of 55. Soil sampling was recommended as part of Phase II investigations.

The USGS conducted subsurface soil sampling for organochloride pesticide/PCB analysis. No organic compounds were detected; there was also no visual evidence of contamination. The USGS prepared the site for closure by preparing a draft decision document recommending that no further remedial actions were needed for Site LF-12. This recommendation, however, was not accepted since no surface soils had been sampled, and PCBs are relatively immobile in the environment. More than 20 surface samples were collected in 1991 and analyzed for pesticides and PCBs; none were found to contain PCBs. Because Site LF-12 is not known to have received hazardous wastes, and the results of surface soil sampling indicated no PCBs on site, an additional NFADD was submitted to HQ Air Combat Command (ACC) in 1992. Site LF-12 was closed out in spring 1994 upon U.S. EPA and MDNR approval of the NFADD submitted in 1992. This site was identified by U.S. EPA as SWMU 12 following the 1992 Preliminary Review/Visual Site Inspection.

BUILDING 744

Building 744 (Site OT-14) is in the northern portion of the main industrial area at the end of Avenue G. The facility was constructed in 1962 and consists of a 12-foot square concrete pad equipped with an 18-inch high concrete dike without floor drains. The facility was used as a test cell for B-52 and KC-135 engines until the early 1970s. The building remained empty until 1979, when it was designated a storage area for PCB-containing transformers and other exterior electric equipment prior to removal by a

licensed transporter for disposal off base. A small portion of Building 744 is now used for hazardous waste storage.

This site was inspected during the 1985 Phase I - Records Search, but since there was no evidence that a PCB release had occurred, the site was excluded from further evaluation. For this reason, Site OT-14 was not scored using the HARM criteria or recommended for study during Phase II investigations.

However, during the USGS Phase II, Stage 1 hydrologic investigations conducted in 1986 and 1987, a groundwater monitoring well was installed downgradient of Site OT-14. The well was sampled for organic compounds and all results were below detection limits.

No further action was recommended for Site OT-14, since no environmental contamination associated with activities at the building was suspected. An NFADD for Sites OT-14 and OT-15 was submitted to HQ SAC in September 1991, and the site was approved for closure by the Air Force in 1992. Site OT-14 was closed out in spring 1994 upon U.S. EPA and MDNR approval of the NFADD. This site was identified as SWMU 1 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

BUILDING 707

Building 707 (Site OT-15) is in the northern portion of the industrial area near the intersection of Avenue D and Seventh Street. This facility was used as a storage shed from approximately the mid-1960s until 1992. The building was approximately 20 feet by 10 feet and was constructed in 1958 to house a drinking water supply well (AF3), which was abandoned around 1963. Between 1965 and 1966, the water pumps and all well-related equipment were removed and a steel cap was welded over the well casing. From the mid-1960s to approximately 1980, insecticides, including DDT, were stored at this facility; and from 1980 to 1992, acetylene gas and propane cylinders were stored there. Building 707 was demolished in June 1992.

This site was inspected during the 1985 Phase I - Records Search, but since no evidence of a release was found, the site was excluded from further evaluation. For this reason, Site OT-15 was not scored using the HARM criteria or recommended for study during Phase II investigations.

During the Phase II, Stage 1 hydrologic investigations conducted by the USGS, water well AF3 was sampled for organic and inorganic chemicals; all chemicals were below detection limits. In 1991, well AF3 was decommissioned and filled with cement grout.

No further action was recommended for Site OT-15, since no environmental contamination associated with activities at the building was suspected. An NFADD for Sites OT-14 and OT-15 was submitted to HQ SAC in September 1991, and the site was approved for closure by the Air Force in 1992. Site OT-15 was closed out in spring 1994 upon U.S. EPA and MDNR approval of the NFADD.

SOIL REMEDIATION AREA

The Soil Remediation Area (Site ST-16) is in the southern portion of the base, between the Former Fighter Alert Hangar (Building 400) and an Aircraft Support and Storage facility (Building 402). The site is a soil stockpile area containing approximately 6,300 cubic yards of petroleum-contaminated soil removed during the basewide UST removal and replacement project.

Prior to the basewide UST removal and replacement project, base personnel conducted a Preliminary Assessment in which the location, content, and volume were identified for each UST on base. During tank removals and replacements, field screening equipment was used to qualitatively assess the degree of contamination at each UST excavation site. All soil showing the presence of VOCs above the detection limit of the field screening device was excavated and stockpiled at Site ST-16 for thermal treatment.

All regulated USTs on K. I. Sawyer AFB were included in a basewide UST removal/replacement program in order to comply with the requirements of 40 Code of Federal Regulations (CFR) 280. The basewide removal/replacement program started in FY 1991 and was completed at the end of calendar year 1992. All new USTs installed under the basewide program have double-walled tanks, leak detection, and corrosion protection, in accordance with federal regulations.

Approximately 6,300 cubic yards of petroleum-contaminated soil were removed during the basewide UST removal/replacement program and stockpiled at Site ST-16. State regulations require this soil to be disposed of as a Type II solid waste or remediated to remove all organic contaminants. Since the county landfill does not accept petroleum-contaminated soils, and because Type II solid wastes cannot be transported out of the county, the selected remedial action for this petroleum-contaminated soil was to remediate on site by installing a low-temperature thermal treatment unit. Following treatment, the soil was sampled and the clean soil was disposed of at Site LF-11.

Thermal treatment of contaminated soils was completed in spring 1994; however, additional contaminated soil may be stored at this site as a result of future storage tank remedial actions. Following completion of all soil

removal/remediation activities, site closure documents will be prepared and submitted for regulator approval.

AVENUE G JP-4 SPILL

The Avenue G JP-4 Spill (Site SS-17) is along the northern flightline area and consists of soil and groundwater contaminated with benzene, JP-4, and toluene. A groundwater contamination plume originates along an underground JP-4 fuel line, which parallels Avenue G and the SAC Operational Apron near the Former Engine Repair Shop (Building 725). The Site SS-17 groundwater contamination plume is partially commingled with the northernmost portion of the Site DP-02 TCE plume.

A groundwater plume contaminated with benzene, believed to originate in the vicinity of Avenue G, was first detected during a 1990 hydrology investigation conducted by the USGS. Numerous monitoring wells were installed in the central part of the base as part of the USGS study, with groundwater samples showing the highest concentrations of benzene along an 1,800-foot strip east (downgradient) of the buried JP-4 line near Avenue G. Elevated concentrations of benzene and toluene were detected in two monitoring wells along this area. Fuel was also detected on top of the water table (0.16 foot) in one monitoring well located along the JP-4 line; however, fuel was not detected during a subsequent check in 1991.

Site SS-17 was added to the K. I. Sawyer AFB IRP in 1992 during the basewide UST removal/replacement project. Four 2,000-gallon waste fuel USTs associated with the Avenue G JP-4 line were removed and replaced. The tanks were originally installed in 1958. Petroleum-contaminated soil was encountered during the UST removal operations and approximately 630 cubic yards of contaminated soil were removed to Site ST-16 for thermal treatment. However, due to the depth of the contamination, not all contaminated soil was removed from the site. This prompted the inclusion of this site into the Central Base TCE and Benzene Groundwater Contamination OU (OU-2) in 1991. OU-2 sites will undergo an RI/FS, scheduled for spring 1996, to better define the extent and type of contamination and evaluate remediation technologies.

As an IRA, a groundwater pump-and-treat system was installed in the central portion of the base along Fifth Street in 1993 and became operational in June 1994. The system's effectiveness in removing contamination from the groundwater will be evaluated to determine if the system should remain in place and/or be expanded to meet remediation goals. Site SS-17 is undergoing a supplemental RI/FS, which is scheduled for completion by fall 1995. Additional investigations to identify the source of groundwater contamination were initiated in summer 1994.

BASE EXCHANGE SERVICE STATION USTs

The Base Exchange (BX) Service Station (Building 826) (Site ST-18) is in the central part of the base on Avenue A. In 1985, a volume discrepancy was noted in a 10,000-gallon UST; therefore, this tank and an adjacent 10,000-gallon tank, originally installed in 1972, were taken out of service shortly afterwards. In 1987, the two 10,000-gallon USTs were removed and replaced with a single 15,000-gallon UST. During removal, a small hole was noticed in one of the tanks. It is estimated that approximately 6,000 gallons of unleaded fuel may have leaked into the surrounding soil. In 1992, two additional 10,000-gallon USTs were removed and replaced.

The USGS conducted a preliminary investigation at Site ST-18 in 1990 as part of a groundwater characterization study. Five groundwater monitoring wells were installed. Elevated levels of benzene, toluene, and xylenes were detected in groundwater samples collected downgradient from Site ST-18, indicating a plume of dissolved benzene may be present.

Site ST-18 was added to the K. I. Sawyer AFB IRP in 1992 after petroleum-contaminated soils were discovered during UST removal/replacement operations. Approximately 630 cubic yards of contaminated soil were removed to Site ST-16 to undergo thermal treatment. However, due to the depth of the contamination, not all contaminated soil was removed from the site. This prompted the inclusion of this site into the Central Base TCE and Benzene Groundwater Contamination OU (OU-2) in 1991. OU-2 will undergo an RI/FS, scheduled for spring 1996, to better define the extent and type of contamination and evaluate remediation technologies.

As an IRA, a groundwater pump-and-treat system was installed in the central portion of the base along Fifth Street in 1993 and became operational in June 1994. Site ST-18 is undergoing a supplemental RI/FS, which is scheduled for completion by fall 1995.

BUILDING 709 USTs

Building 709 (Site ST-19) is in the northern industrial area, near the intersection of Avenue G and Seventh Street. The site consists of five USTs installed in 1959, including four diesel fuel tanks (three 30,000-gallon USTs and one 12,000-gallon UST) and one 2,000-gallon waste oil UST. All USTs were removed from this site in September 1991. During removal operations, contaminated soil was discovered and transported to Site ST-16 for thermal treatment. Although the tanks have never been tightness tested, it is believed that the release of fuel occurred during overfills of the diesel tanks.

Site ST-19 was added to the K. I. Sawyer AFB IRP in 1992 after petroleum-contaminated soils were discovered during UST removal/replacement

operations. Approximately 1,600 cubic yards of contaminated soil were removed to Site ST-16 to undergo thermal treatment. However, due to the depth of the contamination, not all contaminated soil was removed from the site. Therefore, Site ST-19 was included in the Central Base TCE and Benzene Groundwater Contamination OU (OU-2) in 1991. OU-2 will undergo an RI/FS, scheduled for spring 1996, to better define the extent and type of contamination and evaluate remediation technologies.

As an IRA, a groundwater pump-and-treat system was installed in the central portion of the base along Fifth Street in 1993 and became operational in June 1994. At Site ST-19, a supplemental RI/FS is under way and is scheduled for completion by fall 1995. Additional investigations to identify the source of central base groundwater contamination were initiated in summer 1994.

BUILDING 1247 USTs

Building 1247 (Site ST-20) is a BX Service Station in the southeastern part of the base in the residential housing area near the intersection of Voodoo Avenue and Explorer Street. Two 6,000-gallon unleaded gasoline USTs were removed in October 1991. These tanks had been successfully tightness tested in June 1990. An additional 500-gallon uncoated steel UST was discovered and removed in 1991. It is suspected that this tank contained diesel heating fuel for the former filling station building, which was demolished prior to 1980. There are no records of spills or overfills at this site, so the amount of fuel that has been released to the surrounding soil is unknown. The tanks at this site may have contained leaded gasoline; however, this has not been confirmed.

Site ST-20 was added to the IRP in 1992 after soil contamination was discovered during UST removal operations. Soil sampled from the excavation was found to have high concentrations of benzene, toluene, ethylbenzene, and xylene. Approximately 1,050 cubic yards of contaminated soil were removed and transported to Site ST-16 for thermal treatment.

In order to fully characterize the extent of contamination and potential threat to human health at Site ST-20, an RI/FS was completed. The RI was delivered in September 1994 and the FS was delivered in April 1995. A draft Decision Document has been prepared and is being reviewed.

BUILDING 436 USTs

Building 436 (Site ST-21) is a Former Engine Test Facility in the southern portion of the base between the Former Fighter Alert hangar (Building 400) and an Aircraft Support and Storage facility (Building 402). Several underground concrete vaults are located on site, although the exact

dimensions and contents of these vaults is not known. There is almost no information available concerning these vaults since the units that operated the test facility are no longer stationed at K. I. Sawyer AFB. During a visual inspection of the vaults, large quantities of oily liquid were observed, and this liquid may have migrated from the vaults into the surrounding soil.

Site ST-21 was added to the IRP in 1992, due to the presence of the oily liquid discovered during the site inspection. In order to determine the presence and extent of contamination and its potential threat to human health at Site ST-21, an RI/FS is under way. Final remedial actions will be dependent upon the results of the RI/FS, scheduled for completion in March 1995. A planned remedial action, which will include removal of USTs, piping, and any soil contamination, is planned to be completed in 1995.

BUILDING 824 USTs

Building 824 (Site ST-22) is the Base Auto Hobby Shop, located in the central part of the base on Avenue A. A 1,000-gallon waste oil UST, originally installed in 1980, was removed in June 1992.

Site ST-22 was added to the IRP in 1992 after VOC-contaminated soil was discovered during UST removal operations. Approximately 50 cubic yards of petroleum-contaminated soil were collected from the bottom of the excavation and transported to Site ST-16 for thermal treatment. Lead and chromium were also detected in the contaminated soil.

Following the removal of the UST and contaminated soils, Site ST-22 was recommended for no further action by the base and an NFADD was submitted and approved by the regulator and site close-out occurred in March 1995.

BUILDING 610 USTs

Building 610 (Site ST-23) is the Aerospace Ground Equipment Parking Facility, in the central part of the base east of Avenue F between Third and Fourth streets. Three USTs, a 2,000-gallon diesel UST, a 2,000-gallon motor gasoline (MOGAS) UST, and a 3,000-gallon JP-4 UST, originally installed in 1957, were removed from this site in 1992. These USTs were replaced by a 6,000-gallon JP-4 UST, a 10,000-gallon MOGAS UST, and two 15,000-gallon diesel USTs at Building 612.

Site ST-23 was added to the IRP in 1992, after soil contaminated with elevated concentrations of toluene, ethylbenzene, xylene, and polynuclear aromatic hydrocarbons were detected during UST removal operations. Contaminated soil was removed and transported to Site ST-16 for thermal treatment.

In order to fully characterize the extent of contamination and potential threat to human health at Site ST-23, an RI/FS is under way and scheduled for completion in fall 1995.

BUILDING 534 USTs

Building 534 (Site ST-24) is the Military Vehicle Gas Station, located in the central portion of the base near the intersection of Avenue D and Third Street. In 1992, two 4,000-gallon diesel USTs and a 5,000-gallon MOGAS UST were removed as part of the basewide UST removal/replacement project. The three tanks were originally installed in 1957.

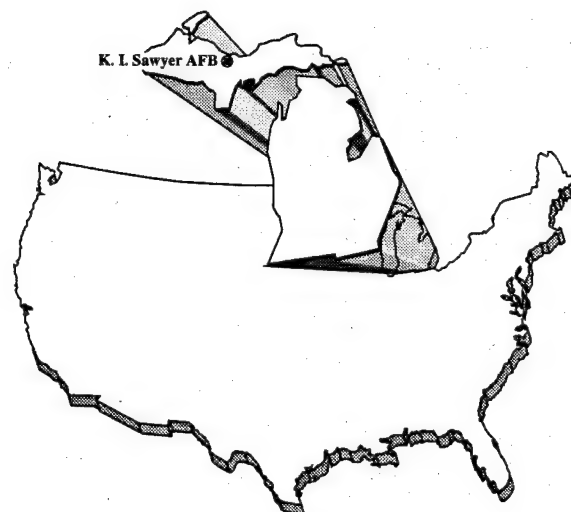
Site ST-24 was added to the IRP in 1992 after soil contamination was discovered during UST removal operations. Soil sampled from the excavation contained high concentrations of toluene, ethylbenzene, and xylene. Contaminated soil was removed and transported to Site ST-16 for thermal treatment.

In order to fully characterize the extent of contamination and potential threat to human health at Site ST-24, an RI/FS is under way and scheduled for completion in fall 1995.

MATERIAL DRYING BEDS

The Material Drying Beds (Site DP-25) are located in the central portion of the base, adjacent to the wastewater treatment plant. The beds were utilized for dewatering and disposal of sewage sludge generated at the wastewater treatment plant from 1960 to 1978. Between 1989 and 1993, the beds were utilized for dewatering and disposal of materials removed from base sand/grease traps and the wastewater treatment plant grit chambers. The site covers approximately 1 acre and may be contaminated with heavy metals, petroleum hydrocarbons, and solvents. The drying beds are not currently in use.

The Material Drying Beds were identified as an Area of Concern during the U.S. EPA's Preliminary Review/Visual Site Inspection survey conducted in 1992 and added to the IRP in 1994. No formal investigations have been conducted at this site. However, base personnel conducted sampling of sludge collected by sand/grease traps, which detected the presence of heavy metals. As a result, an RI/FS is being conducted to assess the threat to human health and the environment, identify remediation goals, and evaluate remediation alternatives.



APPENDIX E

APPENDIX E
METHODS OF ANALYSIS

APPENDIX E

METHODS OF ANALYSIS

1.0 INTRODUCTION

This appendix describes the methods used in preparing this Environmental Impact Statement (EIS). These methods were designed and implemented to evaluate the potential environmental impacts of disposal and reuse of K. I. Sawyer Air Force Base (AFB). Since future reuse of the site is uncertain in its scope, activities, and timing, the analysis considered alternative reuse scenarios and evaluated their associated environmental impacts. The reuse scenarios analyzed in this EIS were defined for this study to span the anticipated range of reuse activities that are reasonably likely to occur due to disposal of the base. They were developed based on proposals put forth by affected local communities, interested individuals, and the Air Force, and considered general land use planning objectives.

The various analysis methods used to develop this EIS are summarized here by resource. In some instances, more detail is included in another appendix. These instances are noted for each resource in its respective subsection below.

2.0 LOCAL COMMUNITY

2.1 COMMUNITY SETTING

The section on community setting was developed to provide the context within which other biophysical impacts could be assessed. Community setting impacts were based on projected direct and secondary employment and resulting population changes related to reuse of K. I. Sawyer AFB. These projections were used to quantify and evaluate changes in demand on community services, transportation systems, air quality, and noise. A complete assessment of socioeconomic effects was conducted through a separate Socioeconomic Impact Analysis Study (SIAS) for the Disposal of K. I. Sawyer AFB, which is the source for baseline and projected statistics used in this EIS.

The SIAS used information from sources including the U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics; U.S. Council of Economic Advisors; U.S. Bureau of the Census; Michigan Department of Economic Development; Northern Michigan University; the counties of Marquette and Delta; the cities of Marquette, Ishpeming, and Negaunee; and the townships of Forsyth, Sands, and West Branch. The analysis used the Regional Interindustry Multiplier System (RIMS II) model to generate

demographic projections associated with the Proposed Action and alternatives.

2.2 LAND USE AND AESTHETICS

Potential land use impacts were projected based on compatibility of land uses associated with the Proposed Action and alternatives with adjacent land uses and zoning; consistency with general plans and other land use plans and regulations; and effects of aircraft noise and safety restrictions on land uses.

The Region of Influence (ROI) for the majority of direct land use impacts for this study consisted of K. I. Sawyer AFB, Marquette County, and the townships of Forsyth, Sands, and West Branch. Noise-related land use impacts were determined by the extent of noise contours created by reuse alternatives and included Marquette County and the townships that surround the base.

U.S. Air Force tab maps, aerial photographs, and windshield surveys were used to characterize on- and off-base land uses. Applicable policies, regulations, and land use restrictions were identified from the land use plans and ordinances of Marquette County, and the townships of Forsyth, Sands, and West Branch. The Proposed Action and alternative reuse plans were compared with existing land use and zoning to identify areas of conflict, as well as to local planning goals and objectives as set forth in General Plans. The other land use concepts were also examined for compatibility with adjacent land uses and with the Proposed Action and alternatives using the same process.

Alternatives incorporating airfield uses were examined for consistency with the K. I. Sawyer AFB Air Installation Compatible Use Zone (AICUZ) study, Federal Aviation Administration (FAA) regulations, and recommended land uses in the vicinity of airfields. Impacts of airfield-generated noise were assessed by comparing the extent of noise-affected areas and receptors under different reuse alternatives with preclosure baseline conditions.

For the aesthetics analysis, the affected environment was described based upon the visual sensitivity of areas within and visible from the base. These areas were identified based on a windshield survey in fall 1993 and a review of aerial photographs. These areas were categorized as high, medium, and low sensitivity. The Proposed Action and alternatives were then evaluated to identify land uses to be developed, visual modifications that would occur, and new areas of visual sensitivity, and to determine whether modification of unique or otherwise irreplaceable visual resources would occur and detract from the visual qualities or setting. Consistency with applicable plans that protect visual resources was also examined.

2.3 TRANSPORTATION

Potential impacts to transportation due to the Proposed Action and alternative reuse plans for K. I. Sawyer AFB focus on key roads, local airport use, and rail service in the area, including those segments of the transportation networks in the region that serve as direct linkages to the base. The need for improvements to on-base roads, off-base access, and regional arterials was considered. The analysis was derived using information from state and local government agencies, including the Michigan Department of Transportation, Marquette County Highway Department, local law enforcement agencies, local airport authorities, and railroad companies. Other data sources used for the roadway analysis include the Institute of Transportation Engineers and the Transportation Research Board. The ROI for the transportation analysis includes the existing principal road, air, and rail networks that serve the local communities of Marquette, Gwinn, Skandia, and Little Lake, with emphasis on the area immediately surrounding K. I. Sawyer AFB.

The number of vehicle trips expected as a result of specific land uses on the site was estimated for 1995, 2000, 2005, and 2015 on the basis of direct on-site jobs and other attributes of on-site land uses (such as the number of dwelling units, and institutional, commercial, industrial, and general aviation activities). Trip Generation Data from the Institute of Transportation Engineers was used to determine vehicle trips. Vehicle trips were then allocated to the local road network using prior patterns and expected destinations and sources of trips. When appropriate, the local road network was adjusted to account for changes over time from currently planned road capacity improvements and improvements required by the proposed reuse scenarios. Changes in work and associated travel patterns were derived by assigning or removing traffic to or from the most direct commuting routes. Changes in traffic volumes arising from reuse alternatives at K. I. Sawyer AFB were estimated and resulting volume changes on key regional, local, and on-base roadway segments were then determined.

The transportation network in the ROI was then examined to identify potential impacts to Levels of Service (LOS) arising from future baseline conditions and the direct and indirect effects of reuse alternatives. The planning application from the Highway Capacity Manual provided estimates of LOS resulting from changes in traffic. The planning procedures used in this analysis were based on forecasts of peak hour volumes and on assumed traffic, roadway, and control conditions. Intersections were considered where appropriate. The results provided an estimate of the changes in LOS ratings expected as a result of traffic volume changes on key regional, local, and on-base roadway segments.

Airspace use in the vicinity of an airport is driven primarily by such factors as runway alignment, surrounding obstacles and terrain, air traffic control

and navigational aid capabilities, proximity of other airports/airspace uses in the area, and noise considerations. These same factors normally apply regardless of whether the airport is used for military or civil aircraft operations. For this reason, a preclosure reference was used in characterizing these factors related to airspace use at K. I. Sawyer AFB.

Historical data on military aircraft operations used to characterize airspace use at and around K. I. Sawyer AFB were obtained from the base. Airport owners/operators were contacted to obtain information on civil airport use, both historical and projected. Military and civil aviation forecasts were derived from conversations with these two groups concerning their expectations of future demand under various scenarios and, where necessary, assumptions were made based on other similar airport operational environments.

The ROI for the airspace analysis is an area within a 20-nautical-mile radius of K. I. Sawyer AFB from the surface up to 12,000 feet above mean sea level (see Figure 3.2-13). This ROI encompasses the airspace delegated to the K. I. Sawyer AFB Radar Approach Control for providing Instrument Flight Rules and Visual Flight Rules flight-following services to aircraft. Additionally, the K. I. Sawyer AFB Air Traffic Control Tower is responsible for providing air traffic control to other airfields in the region to minimize potential airspace conflicts.

The types and levels of aircraft operations projected for the Proposed Action and alternatives were evaluated and compared to the way airspace was configured and used under the preclosure reference. The capacity of the airport to accommodate the projected aircraft fleet and operations was assessed by calculating the airport service volume, using the criteria in the FAA Advisory Circular 150/5060-5. Potential effects on airspace use were assessed, based on the extent to which projected operations could (1) require modifications to the airspace structure or air traffic control systems and/or facilities; (2) restrict, limit, or otherwise delay other air traffic in the region; or (3) encroach on other airspace areas and uses. It was recognized throughout the analysis process that a more in-depth study would be conducted by the FAA, once a reuse plan is selected, to identify any impacts of the reuse activities and what actions would be required to support the projected aircraft operations. Therefore, this analysis was used only to consider the level of operations that could likely be accommodated under the existing airspace structure, and to identify potential impacts if operational capacities were exceeded.

Projections of civil aviation activity for the aviation reuses were derived by (1) defining a Competitive Market Area based on geographical factors and alternative facilities; (2) developing future levels of civilian based aircraft in the defined Competitive Market Area; (3) estimating relocation of these civilian aircraft to K. I. Sawyer AFB after the departure of the active duty

forces based on conversations with airport owners/representatives, as well as assumptions based on similar airport operational environments; and (4) projecting future operational and air traveler visitor levels of activity based on reasonable "rule of thumb" ratios. A similar approach described in steps 3 and 4 above was used to derive activity levels for the air cargo, passenger, and aircraft maintenance scenarios at K. I. Sawyer AFB.

Information regarding existing rail transportation was obtained from the Michigan Department of Transportation.

2.4 UTILITIES

Utility usage was determined based on land uses and projected area population increases. The utility systems addressed in this analysis include the facilities and infrastructure used for potable water (pumping, treatment, storage, and distribution), wastewater (collection and treatment), solid waste (collection and disposal), and energy generation and distribution (electricity and natural gas). Historic consumption data, service curtailment data, peak demand characteristics, storage and distribution capacities, and related information for base utilities (including projections of future utility demand for each utility provider's particular service area) were extracted from various engineering reports and K. I. Sawyer AFB personnel. Information was also obtained from public and private utility purveyors and related county and city agencies.

The ROI for this analysis comprised the service areas of the local purveyors of potable water, wastewater treatment, and energy that serve the surrounding area. The analysis also reviews the existing utilities systems on K. I. Sawyer AFB. It was assumed that these local purveyors would provide services within the area of the existing base after disposal/reuse.

Potential impacts were evaluated based on long-term projections of demand and population obtained from the various utility purveyors within the region (through 2015) for each of their respective service areas. In each case, purveyors provided the most recent comprehensive projections that were either made prior to the base closure announcement or that did not take into account a change in demand from the base. These projections were then adjusted to reflect the decrease in demand associated with closure of K. I. Sawyer AFB and its subsequent operation under caretaker status. These adjusted forecasts were then considered the future baseline for comparison with potential reuse alternatives.

The potential effects of reuse alternatives were evaluated by estimating and comparing the additional direct and indirect demand associated with each alternative to the existing and projected operating capabilities of each utility system. Estimates of direct utility demands on site were used to identify the effects of the reuse activities on site-related utility systems. All changes

to the utility purveyors' long-term forecasts were based on estimated reuse-related population changes in the region, and on the future rates of per capita demand explicitly indicated by each purveyor's projections or derived from those projections. It was assumed that the regional per capita demand rates were representative of the reuse activities, based on assumed similarities between proposed land uses and existing or projected uses in the region. Projections in the utilities analysis include direct demand associated with activities planned on base property, as well as resulting changes in domestic demand associated with population changes in the region.

3.0 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

Two categories of hazardous materials and hazardous waste management issues were addressed for this analysis: (1) impacts of hazardous materials utilized and hazardous wastes generated by each reuse proposal and (2) residual impacts associated with past Air Force practices including delays due to Installation Restoration Program (IRP) site remediation. IRP sites were identified as part of the affected environment (Chapter 3), while remediation impacts associated with these sites were addressed as environmental consequences (Chapter 4). Impacts of wastes generated by each reuse proposal were also addressed in Chapter 4. Primary sources of data were existing published reports such as IRP documents, management plans for various toxic or hazardous substances (e.g., spill response, hazardous waste, asbestos), and survey results (e.g., radon). Pertinent federal, state, and local regulations and standards were reviewed for applicability to the Proposed Action and alternatives. Hazardous materials and waste inventories and a hazardous waste management plan were obtained from K. I. Sawyer AFB. Interviews with personnel associated with these on-base agencies provided the information necessary to fill any data gaps. State and local agencies were also contacted regarding regulations that would apply to both current and post-closure activities for K. I. Sawyer AFB.

The ROI includes the current base property and all geographical areas that have been affected by an on-base release of a hazardous material or hazardous waste. The IRP sites are located within the base boundary with the exception of a trichloroethylene groundwater plume that has migrated beneath the privately owned parcel in the center of the base.

Preclosure baseline conditions as defined for this study include current hazardous materials/waste management practices and inventories pertaining to the following areas: hazardous materials, hazardous waste, IRP sites, aboveground and underground storage tanks, asbestos, pesticides, polychlorinated biphenyls (PCBs), radon, medical/biohazardous waste, ordnance, and lead-based paint. The impact analysis considered (1) the amount and type of hazardous materials/waste currently associated with specific facilities and/or areas proposed under each reuse alternative; (2) the

regulatory requirements or restrictions associated with property transfer and reuse; (3) delays to development due to IRP remediation activities; and (4) remediation schedules of specific hazardous materials/waste (e.g., PCBs, medical/biohazardous waste) currently used or generated by the Air Force.

4.0 NATURAL ENVIRONMENT

4.1 GEOLOGY AND SOILS

Evaluation of soils impacts addressed erosion potential, construction-related dust generation and other soils problems (low soil strength, expansive soils, etc.), and disturbance of unique soil types. Information was obtained from several federal, state, and local agencies. Assessment of potential impacts to geology from the reuse alternatives included evaluation of resource potential (especially aggregates), geologic hazards (particularly potential for seismicity, liquefaction, and subsidence), and flooding potential.

The ROI for the geologic analysis included the region surrounding K. I. Sawyer AFB relative to seismic activity, mineral resources, and flooding potential. The ROI for the soils analysis was limited to the base and specific areas designated for construction or renovation.

The soils analysis was based on a review of Natural Resources Conservation Service documents for soil properties. The soils in the ROI were then evaluated for erosion potential, permeability, evidence of hardpans, expansive soil characteristics, etc., as these relate to construction problems and erosion potential during construction. Mitigations were evaluated based on county ordinances and Natural Resources Conservation Service recommendations. Common engineering practices were reviewed to determine poor soil characteristics and recommended mitigation measures.

The geologic analysis was based on a review of existing literature for construction problems associated with geologic hazards, availability of construction aggregate, and whether reuse would impact the availability of known mineral resources.

4.2 WATER RESOURCES

Analysis of impacts of the reuse alternatives on water resources considered groundwater quality and quantity, surface water quality (effects from erosion or sedimentation and contamination), surface water drainage diversion, and non-point source surface runoff and water availability. Impacts to water quality resources resulting from IRP activities were addressed under Hazardous Materials and Hazardous Waste Management. Information was obtained from several federal, state, and local agencies. The ROI for water resources included the groundwater basin underlying the

base, the surface drainage directly affected by runoff from the base, and the 100-year floodplain in the vicinity of the base.

Existing surface water conditions were evaluated for flood potential, non-point source discharge or transportation of contaminants, and surface water quality. Groundwater quality and the potential as a potable water source for each reuse alternative was documented. The existing storm water drainage system was evaluated based on available literature, and the impacts to this system from each of the reuse alternatives were determined.

4.3 AIR QUALITY

The air quality resource is defined as the condition of the atmosphere, expressed in terms of the concentrations of air pollutants occurring in an area as the result of emissions from natural and/or man-made sources. Reuse alternatives have the potential to affect air quality depending on net changes in the release of both gaseous and particulate matter emissions. The impact significance of these emission changes was determined by comparing the resulting atmospheric concentrations to state and federal ambient air quality standards. This analysis drew from climatological data, air quality monitoring data, baseline emission inventory information, construction scheduling information, reuse-related source information, and transportation data. Principal sources of these data were the U.S. Environmental Protection Agency, Michigan Department of Natural Resources-Air Quality Division, K. I. Sawyer AFB Bioenvironmental Engineer, and Weather Squadron.

The ROI was determined by emissions from sources associated with construction and operation of the reuse alternatives. For inert pollutant emissions (all pollutants other than ozone and its precursors), the measurable ROI is limited to a few miles downwind from the source, (i.e., the immediate area of K. I. Sawyer AFB). The ROI for ozone impacts from project emissions included the upper Michigan Air Quality Control Region.

Emissions predicted to result from the proposed alternatives were compared to existing baseline emissions to determine the potential for adverse air quality impact. Impacts were also assessed by modeling, where appropriate, and compared to air quality standards. Appendix I contains the projected emissions inventory information and methods. Estimated background concentrations were added to the reuse-related impacts for comparison with the standards. Impacts were considered significant if reuse-related emissions would (1) increase an off-site ambient pollutant concentration from below to above a federal or state standard or (2) expose sensitive receptors (such as schools or hospitals) to substantial pollutant concentrations. All other air quality impacts were considered insignificant.

4.4 NOISE

The noise analysis addressed potential noise impacts from reuse-generated aircraft operations, surface traffic, and other identified noise sources on communities surrounding K. I. Sawyer AFB. Most of the data were obtained from the aircraft operations and traffic data prepared for the reuse alternatives. Day-night levels (DNL) were used to determine noise impacts. A single-event noise analysis using sound exposure levels (SELs) was also performed. In addition, scientific literature on noise effects was referenced.

The ROI for noise was defined as the area within DNL 65 decibel (dB) contours based on land use compatibility guidelines developed from FAA regulations. The ROI for surface traffic noise impacts incorporated key road segments identified in the transportation analysis.

Noise levels from aircraft operations were estimated using the FAA-approved Integrated Noise Model (INM), Version 4.11. Noise contours for DNL 65 dB and above were depicted. Noise levels due to surface traffic were estimated using the Federal Highway Administration's Highway Noise Model. Potential noise impacts were identified by overlaying the noise contours with land use and population information to determine the number of residents who would be exposed to DNL above 65 dB.

SELs related to reuse alternatives were provided for representative noise sensitive receptors exposed to aircraft noise from the K. I. Sawyer AFB airfield. The SELs presented were outdoor levels and took into account the location of the receptors relative to the various flight tracks and aircraft profiles used. Noise reduction effects for common construction were included in the sleep interference analysis; however, evaluation of sensitive receptors relative to noise reduction levels of specific structures was not performed.

Methods used to analyze noise impacts under each reuse scenario are presented in detail in Appendix J of this EIS.

4.5 BIOLOGICAL RESOURCES

For analysis of impacts, biological resources were divided into vegetation, wildlife, threatened and endangered species, and sensitive habitats. Data sources included general plans; aerial photographs, environmental evaluations, and inventories or descriptions of the base; U.S. Fish and Wildlife Service National Wetlands Inventory maps; rare, candidate, threatened, and endangered species lists; general information from federal and state agencies; and the following reference books: Gray's Manual of Botany, Michigan Trees, Shrubs of Michigan, Michigan Wildflowers, Michigan Mammals, the Atlas of Breeding, Birds of Michigan, Mammals of the Eastern United States, Birds of North America, and Atlas of North

American Freshwater Fishes. Site visits were conducted to gather information on habitat quality and to map vegetation, wetlands, and other sensitive habitats.

The ROI for biological resources included the base property and off-base drainages that receive runoff from base surface water.

Analysis of impacts to vegetation included the effects of management practices, construction disturbance, herbicide use, or possible toxic contamination. Wildlife impacts addressed included habitat destruction, increased stress from noise or human presence, and individual mortality from airplane strikes. Impacts to candidate, threatened, and endangered species were especially noted where applicable. Sensitive habitats were defined as areas protected by regulations (such as wetlands and habitat for protected species), and plant communities having agency concern for being unusual, being limited in distribution, or being important seasonal use areas for wildlife. Impacts to sensitive habitats that may occur from habitat loss or degradation, noise impacts, increase in human use of an area, and other sources were addressed.

Some potential indirect impacts to biological resources considered in this analysis included erosion (habitat loss, water pollution) and recreational use of natural areas. Standard biological regulations, such as the Endangered Species Act and Clean Water Act, were considered in this analysis.

4.6 CULTURAL RESOURCES

Cultural resources generally include three main categories: prehistoric resources, historic structures and resources, and traditional resources. For the purposes of this EIS, cultural resources were defined to also include paleontological resources (the fossil evidence of past plant and animal life). Prehistoric resources are places where human activity has measurably altered the earth or left deposits of physical remains. Historic structures and resources include standing structures and other physical remains of historic significance. Traditional resources are topographical areas, features, habitats, plants, animals, minerals, or archaeological sites that contemporary Native Americans or other groups value presently, or did so in the past, and consider essential for the persistence of their traditional culture. Cultural resources of particular concern include properties listed on the National Register of Historic Places (NRHP), properties potentially eligible for the NRHP, and sacred Native American sites and areas.

Data used to compile information on these resources were obtained from material on file at K. I. Sawyer AFB; a basewide archaeological survey; interviews with individuals familiar with the history, archaeology, or paleontology of the Upper Peninsula of Michigan; and records of the Information Center of the Michigan Archaeological Inventory. The ROI for

cultural resources included all areas within the boundaries of K. I. Sawyer AFB.

The EIS contains the most up-to-date information on the importance of cultural resources on K. I. Sawyer AFB, based on recent and ongoing evaluation of eligibility for the NRHP. Cultural resources for which eligibility information was unavailable were assumed to be eligible for the NRHP, as is stipulated in the National Historic Preservation Act (NHPA).

According to NRHP criteria (36 Code of Federal Regulations [CFR] 60.4), the quality of significance is present in districts, sites, buildings, structures, and objects that:

- Are associated with events that have made a significant contribution to the broad patterns of history
- Are associated with the lives of persons significant in the past
- Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic value; or represent a significant and distinguishable entity whose components may lack individual distinction
- Have yielded, or may be likely to yield, information important in prehistory or history.

To be listed in or considered eligible for listing in the NRHP, a cultural resource must meet at least one of the above criteria and must also possess integrity of location, design, setting, materials, workmanship, feeling, and association. Integrity is defined as the authenticity of a property's historic identity, as evidenced by the survival of physical characteristics that existed during the property's historic or prehistoric occupation or use. If a resource retains the physical characteristics it possessed in the past, it has the capacity to convey information about a culture or people, historical patterns, or architectural or engineering design and technology.

Compliance with requirements of cultural resource laws and regulations ideally involves four basic steps: (1) identification of significant cultural resources that could be affected by the Proposed Action or alternatives, (2) assessment of the impacts or effects of these actions, (3) determination of significance of potential historic properties within the ROI, and (4) development and implementation of measures to eliminate or reduce adverse impacts. The primary law governing cultural resources in terms of their treatment in an environmental analysis is the NHPA, which addresses the protection of archaeological, historic, and Native American resources. In compliance with Sections 106 and 111 of the NHPA, the Air Force is consulting with the State Historic Preservation Officer.

Adverse effects that may occur as a result of base reuse are those that have a negative impact on characteristics that make a resource eligible for listing on the NRHP. Actions that can diminish the integrity, research potential, or other important characteristics of a historic property include the following (36 CFR 800.9):

- Physical destruction, damage, or alteration of all or part of the property
- Isolating the property from its setting or altering the character of the property's setting when that character contributes to the property's qualification for the NRHP
- Introduction of visual or auditory elements that are out of character with the property or that alter its setting
- Transfer or sale of a federally owned property without adequate conditions or restrictions regarding its preservation, maintenance, or use
- Neglect of a property, resulting in its deterioration or destruction.

Regulations for implementing Section 106 of the NHPA indicate that the transfer, conveyance, lease, or sale of an historic property are procedurally considered to be adverse effects, thereby ensuring full regulatory consideration in federal project planning and execution. However, effects of a project that would otherwise be found to be adverse may not be considered adverse if one of the following conditions exists:

- When the historic property is of value only for its potential contribution to archaeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines
- When the undertaking is limited to the rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of the affected historic property through conformance with the Secretary's Standards for Rehabilitation and Guidelines for Rehabilitation of Historic Buildings
- When the undertaking is limited to the transfer, conveyance, lease, or sale of an historic property, and adequate restrictions or conditions are included to ensure preservation of the property's significant historic features.

The treatment of paleontological resources is governed by Public Law 74-292 (the National Natural Landmarks Program, implemented by 36 CFR 62). Only paleontological remains determined to be significant are subject to consideration and protection by a federal agency. Among the criteria used for National Natural Landmark designation are illustrative character, present condition, diversity, rarity, and value for science and education.

4.7 ENVIRONMENTAL JUSTICE

An Environmental Justice analysis is an examination of adverse impacts that would occur from a proposed action and its alternatives to determine if these adverse impacts would disproportionately affect areas with low-income and/or minority populations. Low-income populations include families below the poverty level (\$12,764 for a family of four in 1989, as reported in the 1990 Census of Population and Housing). Minority populations are identified as Black; American Indian, Eskimo or Aleut; Asian or Pacific Islander; Hispanic; or other.

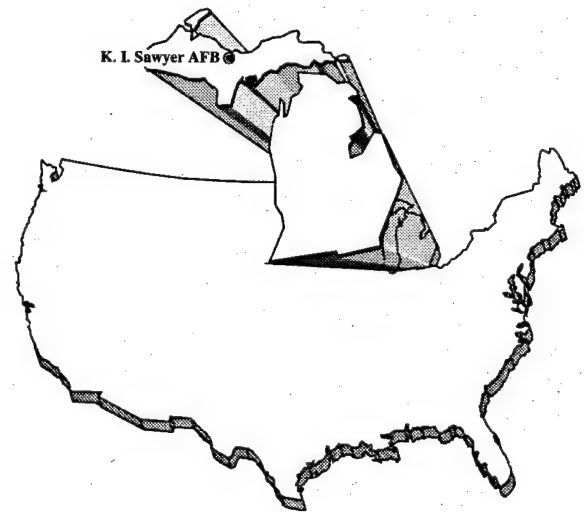
The Region of Comparison (ROC) for Environmental Justice impacts is defined as the smallest political unit that encompasses the area in which the majority of environmental impacts associated with a proposed action or its alternatives would occur. For the disposal and reuse of K. I. Sawyer AFB, the ROC is defined as Marquette County.

To identify areas of low-income and or minority populations within the ROC, 1990 Census of Population and Housing data for Marquette County were used. The U.S. Department of Commerce, Bureau of the Census, has grouped census data in Marquette County by Block Numbering Areas (BNAs). Data for each BNA were compared to Marquette County data to determine which BNAs have disproportionately high low-income populations and minority populations. BNAs with percentages of low-income populations and minority populations greater than the Marquette County average are defined as disproportionate. A Geographic Information System database was utilized to create a plot of the BNAs in the ROC (Marquette County).

The EIS analysis is the basis for identifying Environmental Justice impacts. Adverse impacts that may occur independent of the disposal and reuse of K.I. Sawyer AFB, such as the cleanup of on-site contamination, were not considered in the property analysis because they are not resulting from the disposal action. Impacts are considered adverse if they would result in a deleterious effect on human health or the environment that is significant, unacceptable, or above generally accepted norms. The area in which the projected adverse impacts would occur is referred to as the Resource Adverse Impact Footprint (RAIF). The RAIF is identified for each resource area because its extent may vary for each resource examined.

To determine BNAs potentially affected by the Proposed Action and alternatives, the RAIFs for each resource area were overlaid on a map of the BNAs. All disproportionately high low-income and minority BNAs touched by the RAIFs are identified. Aerial photographs (May 1993) were examined to determine if residential areas are located within the RAIF. Disproportionately high and adverse impacts are considered to occur where the RAIF overlies residential areas within disproportionately high low-income and/or minority BNAs.

For the disposal and reuse of K. I. Sawyer AFB disproportionately high and adverse impacts were identified only for the noise resource. Only surface traffic noise was identified as affecting BNAs with disproportionately high minority populations and/or low-income populations. Because aircraft noise contours do not affect any residents, no aircraft noise impacts would occur.



APPENDIX F

APPENDIX F

ENVIRONMENTAL PERMITS HELD BY K. I. SAWYER AIR FORCE BASE

APPENDIX F

ENVIRONMENTAL PERMITS HELD BY K. I. SAWYER AIR FORCE BASE

Permit No.	Permitted Facility/Equipment	Issuing Agency	Original Date Issued	Date of Expiration
Air Emissions				
24-78I	Hospital Incinerator	MDEQ	9/11/78	Indefinite
914-87	Heat Plant	MDEQ	2/1/88	Indefinite
846-87	Heat Plant	MDEQ	2/1/88	Indefinite
337-84	Heat Plant	MDEQ	5/30/84	Indefinite
389-85	JP-10 Tanks	MDEQ	5/14/86	Indefinite
125-72	Explosive Ordnance Disposal Range	MDPH	5/16/72	Indefinite
475-92	Plastic Media Blast Cabinet	MDEQ	5/1/93	Indefinite
474-92	Plastic Media Blast Cabinet	MDEQ	7/16/92	Indefinite
111-93	Soil Remediation	MDEQ	10/15/93	Indefinite
74-92	Groundwater Treatment Facility	MDEQ	9/24/93	Indefinite
RCRA				
Part B ^(a)	Defense Reutilization and Marketing Office	MDEQ	Application submitted 9/88	To Be Determined
Part X ^(a)	Explosive Ordnance Disposal Range	MDEQ	Application submitted 5/90	To Be Determined
Sewer Discharge				
MI0021423	NPDES-Base Wastewater Treatment Plant	MDEQ	3/13/84	2/28/88
Pending ^(b)	Basewide storm water	MDEQ	Pending Approval	To Be Determined
MI0052990	NPDES-Groundwater Treatment Facility	MDEQ	4/22/93	10/1/97
93-03-0041	Groundwater Treatment Facility (Inland Lakes and Streams Permit)	MDEQ	9/15/93	12/31/94

Notes: (a) Acting under interim status, pending permit approval.

(b) Air Combat Command Group Application in process.

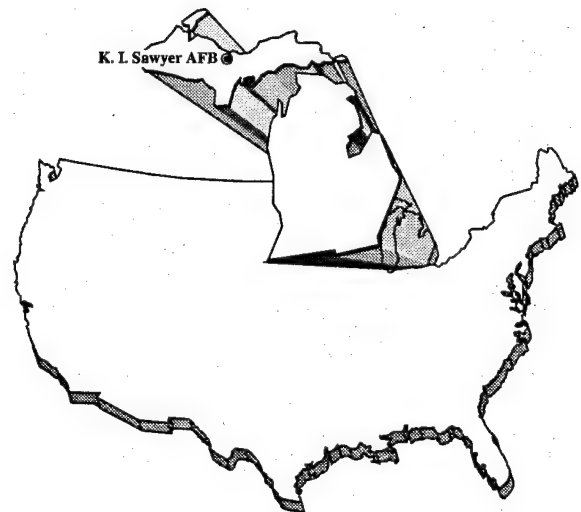
MDEQ = Michigan Department of Environmental Quality

MDPH = Michigan Department of Public Health

NPDES = National Pollutant Discharge Elimination System

RCRA = Resource Conservation and Recovery Act

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APPENDIX G

APPENDIX G

**STORAGE TANKS, OIL/WATER SEPARATORS, PESTICIDE STORAGE, AND SOLID
WASTE MANAGEMENT UNITS AND AREAS OF CONCERN
AT K. I. SAWYER AIR FORCE BASE**

Table G-1. Waste Oil Collection Points

Building	Description	Capacity (gallons)	Method of Storage
333	Ammunition Storage	550	UST
411	Hydrant Fueling System Pumphouse	550	UST
417	Defense Reutilization and Marketing Office	Variable	55-gallon drums
421	Storage Facility	Unknown	Unknown
431	Survival Equipment Shop	500	Bowser
438	Refueling Maintenance	6,000	UST associated with oil/water separator
521	Heating Facility	2,000	UST
530	Vehicle Maintenance	500	Concrete tank associated with oil/water separator
608	Vehicle Maintenance	785	Concrete tank associated with oil/water separator
609	Refueling Vehicle Maintenance	5,000	UST
627	Organizational Maintenance	500	Bowser
668	Fuel Cell Maintenance	Unknown	Concrete tank associated with oil/water separator
709	Electrical Power Generator Building	1,000	UST
720	Hydrant Fuel Pump House	1,000	UST
721	Hydrant Fuel Pump House	1,000	UST
723	Hydrant Fuel Pump House	1,000	UST
724	Hydrant Fuel Pump House	1,000	UST
740	Jet Engine Maintenance	500	Bowser
742	Jet Engine Test Cell	1,000	UST associated with oil/water separator
824	Auto Hobby Shop	1,000	UST
826	BX Service Station	550	UST
869	Sewage Treatment Plant	1,000	UST associated with oil/water separator
4005	Aircraft Maintenance	2,000	UST associated with oil/water separator
4009	Integrated Maintenance	2,000	UST associated with oil/water separator
4010	Aircraft Support Equipment Shop	1,900	Concrete tank associated with oil/water separator
4033	Refueling Vehicle Maintenance	1,000	UST associated with oil/water separator
4035	Weapons Training Maintenance	550	Concrete tank associated with oil/water separator
7083	Fire Training Facility	Unknown	Unknown

BX = Base Exchange

UST = underground storage tank

Table G-2. Solid Waste Management Units and Areas of Concern
Page 1 of 4

SWMU	Names/Description
1 ^(a)	Hazardous Waste Storage Area - Building 744
2 ^(a)	Hazardous Waste Storage Area - Building 417
3 ^(a)	Defense Reutilization and Marketing Office Storage Yard - Facility 419
4 ^(a)	POL Area Tank Confinement Berms
5	Open Burning/Open Detonation Range (EOD Range) - Facility 5029
6 ^(a)	Fire Training Area No. 1
7 ^(a)	Fire Training Area No. 2 - Facility 7083
8 ^(a)	Landfill No. 1
9 ^(a)	Landfill No. 2
10 ^(a)	Landfill No. 3
11 ^(a)	Landfill No. 4
12 ^(a)	Hardfill No. 2
13 ^(a)	Drainage Ponds No. 1
14 ^(a)	Drainage Ponds No. 2
15 ^(a)	Drainage Ponds No. 3 - Building 740
16 ^(b)	Hospital Incinerator - Building 850
17 ^(b)	Classified Document Incinerator
18 ^(b)	Coal-Fired Boilers, Cyclones, and Electrostatic Precipitators, Power Plant - Building 521
19 ^(b)	Wood-Chip/Coal Fired Boiler Cyclone & Baghouses, Power Plant - Building 521
20 ^(b)	Boiler Ash Collection System and Silo, Power Plant - Building 521
21 ^(b)	Current Boiler Ash Loading Room, Power Plant - Building 521
22 ^(b)	Former Boiler Ash Loading Room, Power Plant - Building 521
23	Former Ash Settling Pit, Power Plant - Building 520
24 ^(b)	Boiler Blowdown Gravel Disposal Bed, Power Plant - Building 521
25 ^(b)	Cooling Tower Blowdown Discharge Areas, Power Plant - Building 521
26	Sanitary Sewer System - Basewide System
27	Storm Sewer System - Basewide System
28	Influent Wet Well, WWTP
29	Primary Clarifiers, WWTP - Building 869
30	Rotating Biological Contactors, WWTP - Building 863
31	Rotating Biological Contactors Tank, WWTP - Building 863
32	Secondary Clarifiers, WWTP
33	Effluent Wet Well, WWTP
34	Inactive Rapid Sand Filters, WWTP - Building 862
35	Chlorine Contact Chamber, WWTP - Building 864
36	Dechlorination Cylinders, WWTP - Building 864
37	Sludge Holding Tank, WWTP
38	Sludge Gravity Thickener, WWTP
39	Aerobic Digestors (4), WWTP - Building 857
40	Sludge Decant Tank, WWTP

EOD = explosive ordnance disposal
POL = petroleum, oil, and lubricants
SWMU = solid waste management unit
WWTP = wastewater treatment plant

Table G-2. Solid Waste Management Units and Areas of Concern
Page 2 of 4

SWMU	Names/Description
41	Sludge Storage Tanks, WWTP - Building 4006
42	Industrial Wastewater Aerator Lagoon, WWTP
43	Industrial Wastewater Oil/Water Separator and Waste Oil UST, WWTP - Building 869
44	Former Treatment Plant Units (Dosing Chamber, Trickling Filter, Final Settling Tanks), WWTP - Building Removed
45	Former Sludge Digestors and Sludge Drying Beds, WWTP - Building Removed
46	Land Surface Sludge Disposal Sites - various locations
47 ^(b)	"Safety Kleen" Units & Parts Cleaners - various locations
48 ^(b)	Carpenter Shop Waste Sawdust Collection System
49	Former Oil Storage UST - Building 709
50 ^(b)	Current Waste Oil UST - Building 709
51	POL Area Waste POL Storage Pump - Building 405
52 ^(b)	Liquid Fuels Maintenance Temporary Waste Storage Area - Building 438
53 ^(b)	Propulsion Branch Hazardous Waste Accumulation Area - Building 740/741
54 ^(b)	Equipment Maintenance Hazardous Waste and Waste Oil Accumulation Area - Building 431
55 ^(b)	Aerospace Ground Equipment Waste Oil Accumulation Area - Building 610
56 ^(b)	Spent Battery Storage Area - Building 610
57 ^(c)	Inactive Lime Pit - Building 610
58 ^(b)	Corrosion Control Waste Paint Accumulation Area - Building 667
59 ^(b)	Corrosion Control Media Blaster Filter and Hazardous Waste Accumulation Area - Building 667
60 ^(b)	Corrosion Control Solvent Still - Building 667
61 ^(b)	Corrosion Control Still Bottom Hazardous Waste Accumulation Area - Building 667
62 ^(b)	Current Pneudraulics Waste Oil Accumulation Area - Building 725
63 ^(b)	Non-Destructive Test Hazardous Waste Accumulation Area - Building 725
64 ^(b)	Battery Shop Spent Battery Storage Area - Building 725
65	Inactive/Former Lime Pit - Building 725
66 ^(b)	Former Spent Carbon Remover Storage Tank - Building 725
67 ^(b)	Former Pneudraulics Waste Oil Storage Tank - Building 725
68 ^(b)	Hazardous Waste Accumulation Area - Building 824
69 ^(b)	Current Waste Oil Accumulation Area - Building 824
70	Waste Oil UST - Building 824
71 ^(b)	Paint Booth Filters - Building 824
72 ^(b)	Silver Recovery Unit - Building 601
73	Base Exchange Gas Station Waste Oil UST - Building 826
74 ^(b)	Equipment Maintenance Current Hazardous Waste and Waste Oil Accumulation Area - Building 441
75 ^{(b)(d)}	Equipment Maintenance Former Waste POL Accumulation Area - Building 400/441
76 ^(b)	Weapons Release Waste POL Accumulation Area - Building 400
POL = petroleum, oil, and lubricants SWMU = solid waste management unit UST = underground storage tank WWTP = wastewater treatment plant	

Table G-2. Solid Waste Management Units and Areas of Concern
Page 3 of 4

SWMU	Names/Description
77 ^(b)	Civil Engineering Squadron Paint Shop Hazardous Waste Accumulation Area - Building 408
78 ^(b)	Hazardous Waste Accumulation Area - Building 608
79 ^(b)	Vehicle Maintenance Waste Oil/Hydraulic Fluid Bowser - Building 608
80 ^(c)	Inactive Lime Pit - Building 608
81	Paint Booth Filters - Building 608
82 ^(b)	Waste POL UST - Building 609
83 ^(b)	Heavy Equipment Maintenance Waste Oil Bowser - Building 530
84 ^(b)	Heavy Equipment Maintenance Waste Oil Accumulation Drums - Building 530
85 ^(b)	Missile Maintenance Hazardous Waste Accumulation Area - Building 331
86 ^(b)	Missile Maintenance Waste JP-10 Storage Can - Building 331
87 ^(b)	Missile Maintenance Paint Booth Filters - Building 331
88 ^(b)	Fuel System Maintenance Hazardous Waste Accumulation Cabinet - Building 668
89	Inactive Oil Detention Tank - Building 668
90 ^(b)	Waste POL Accumulation Area - Building 402
91	Contaminated Soil Storage Area - south of Building 902
92 ^(e)	Maintenance Building Floor Drains and Trenches - Buildings 331, 438, 441, 530, 608, 609, 664, 667, 668, 742
93	POL Area Oil/Water Separator - Building 405
94	Oil/Water Separator and Waste Oil UST - Building 438
95	Equipment Maintenance Oil/Water Separator - Building 441
96	Vehicle Maintenance Oil/Water Separator - Building 608
97	Refueling Maintenance Oil/Water Separator and Waste Oil UST - Building 609
98	Propulsion Branch Oil/Water Separator and Waste Oil UST - Building 742
99	Oil/Water Separator and Waste Oil UST - Building 331
100	Heavy Equipment Maintenance Oil/Water Separator and Waste Oil UST - Building 530
101	Weapons Loading Oil/Water Separator and Waste Oil UST - Building 664
102	Fire Training Area No. 2 Oil/Water Separator and Tile Drain Field
POL = petroleum, oil, and lubricants SWMU = solid waste management unit UST = underground storage tank	

Table G-2. Solid Waste Management Units and Areas of Concern
Page 4 of 4

AOC	Names/Description
103	Operational Apron Underground Jet Fuel Storage Tanks and Supply Lines
104 ^(f)	15 Other USTs - various locations
105	Coal Storage Piles - Power Plant
106	Rifle Range Backstop - Building 5023
107	Trichloroethylene (TCE) contamination near former Engine Repair Shop - Building 725
F	B-52 Crash Site
G	Aboveground Tank - Building 222
H	Former Grenade Range, Weapon Storage Area
I	40 mm Grenade Range, West Side of Runway
J	Spill Cleanup/Investigation - Building 304
K	Spill Cleanup/Investigation - Building 539
L	Drain Pits and Sumps at Industrial Facilities
M	Drainfields and Bypass Systems associated with the Sanitary Sewer System
N	Morale, Welfare, and Recreation and Private Vehicle Parking Areas - Building 504 and Facility 7067

Notes: (a) SWMU/AOC also under Installation Restoration Program investigation.

(b) SWMU with low release potential.

(c) SWMU remediated in summer 1994.

(d) Each facility POL accumulation area is counted as a separate SWMU.

(e) Each facility floor drain and trench are counted as a separate SWMU.

(f) Tank replacement program conducted under Michigan Department of Natural Resources guidelines.

AOC = Area of Concern

mm = millimeter

POL = petroleum, oil, and lubricants

UST = underground storage tank

SWMU = solid waste management unit

Source: Department of Defense, 1994.

Table G-3. Inventory of Underground Storage Tanks (as of March 30, 1994)
Page 1 of 2

Building	Capacity (gallons)	Content	Date of Installation	Construction Material
120	4,000	Diesel Fuel	1991	Steel ^(b)
220	1,000	Propane	Unknown	Unknown
318	4,000	Diesel Fuel	1992	Steel ^(b)
302	50,000	Water	1957	Unknown
331-1	2,000	Waste JP-10	1987	Steel ^(b)
331-2	7,000	JP-10	1987	Steel ^(b)
331-3	7,000	JP-10	1987	Steel ^(b)
331-4	7,000	JP-10	1987	Steel ^(b)
331-5	7,000	JP-10	1987	Steel ^(b)
333	550	Waste Oil	1987	Steel ^(b)
336	7,000	Diesel Fuel	1987	Steel ^(b)
405 ^(a)	4,000	Waste JP-4	Unknown	Steel
411	550	JP-4	1992	FRP ^(b)
413	550	JP-4	1992	FRP ^(b)
438-1	6,000	Waste Oil	1987	Steel ^(b)
438-2	10,000	Aqueous Film-Forming Foam	1987	Steel ^(b)
438-3	10,000	Aqueous Film-Forming Foam	1987	Steel ^(b)
441	550	Waste Oil	1987	FRP ^(b)
521-1 ^(a)	2,000	Waste Oil	1962	Unknown
521-2	10,000	Diesel Fuel	1988	Steel ^(b)
530	1,000	Waste Oil	1994	Bitum Coated Steel
603	1,000	Diesel Fuel	1992	FRP ^(b)
609-1	1,000	Waste JP-4	1991	FRP ^(b)
609-2	5,000	Waste JP-4	1991	Steel ^(b)
612-1	6,000	JP-4	1992	Steel ^(b)
612-2	10,000	Gasoline	1992	Steel ^(b)
612-3	15,000	Diesel Fuel	1992	Steel ^(b)
612-4	15,000	Diesel Fuel	1992	Steel ^(b)
664 ^(a)	2,000	Waste Oil	1987	Steel
701	550	Hydraulic Fluid	Unknown	Unknown
709-1	1,000	Waste Oil	1991	Steel ^(b)
709-2	15,000	Diesel Fuel	1991	Steel ^(b)
709-3	15,000	Diesel Fuel	1991	Steel ^(b)
720-1	1,000	Waste JP-4	1991	FRP ^(b)
720-2	50,000	JP-4	1958	Epoxy Coated Steel
720-3	50,000	JP-4	1958	Epoxy Coated Steel
720-4	50,000	JP-4	1958	Epoxy Coated Steel

FRP = fiberglass-reinforced plastic

Table G-3. Inventory of Underground Storage Tanks (as of March 30, 1994)

Page 2 of 2

Building	Capacity (gallons)	Content	Date of Installation	Construction Material
720-5	50,000	JP-4	1958	Epoxy Coated Steel
721-1	1,000	Waste JP-4	1991	FRP ^(b)
721-2	50,000	JP-4	1958	Epoxy Coated Steel
721-3	50,000	JP-4	1958	Epoxy Coated Steel
721-4	50,000	JP-4	1958	Epoxy Coated Steel
721-5	50,000	JP-4	1958	Epoxy Coated Steel
723-1	1,000	Waste JP-4	1991	FRP ^(b)
723-2	50,000	JP-4	1958	Epoxy Coated Steel
723-3	50,000	JP-4	1958	Epoxy Coated Steel
723-4	50,000	JP-4	1958	Epoxy Coated Steel
723-5	50,000	JP-4	1958	Epoxy Coated Steel
723-6	50,000	JP-4	1958	Epoxy Coated Steel
723-7	50,000	JP-4	1958	Epoxy Coated Steel
724-1	1,000	Waste JP-4	1991	FRP ^(b)
724-2	50,000	JP-4	1958	Epoxy Coated Steel
724-3	50,000	JP-4	1958	Epoxy Coated Steel
724-4	50,000	JP-4	1958	Epoxy Coated Steel
724-5	50,000	JP-4	1958	Epoxy Coated Steel
724-6	50,000	JP-4	1958	Epoxy Coated Steel
724-7	50,000	JP-4	1958	Epoxy Coated Steel
726	550	Diesel Fuel	1992	FRP ^(b)
742	1,000	JP-4	Unknown	Unknown
747	2,000	Diesel Fuel	1993	FRP ^(b)
824	1,000	Waste Oil	1992	Steel ^(b)
826-1	550	Waste Oil	1992	FRP ^(b)
826-2	10,000	Gasoline	1992	Steel ^(b)
826-3	10,000	Gasoline	1992	Steel ^(b)
826-4	15,000	Gasoline	1987	Steel ^(b)
869	1,000	Waste Oil	1991	FRP ^(b)
1247-1	15,000	Gasoline	1991	Steel ^(b)
1247-2	15,000	Gasoline	1991	Steel ^(b)
5060	1,000	Diesel Fuel	1992	FRP ^(b)

Notes: (a) Regulated UST does not meet 1998 compliance standard.

(b) UST meets 1998 compliance standards (double walled with automatic leak detection, spill/overfill protection, corrosion protection, and liquid level monitoring).

FRP = fiberglass-reinforced plastic

UST = underground storage tank

Source: Department of Defense, 1994.

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 1 of 4

Building	Capacity (gallons)	Content	Date of Installation
101	275	Diesel Fuel	1981
107 ^(a)	275	Diesel Fuel	1981
108-1	100	Gasoline	Unknown
108-2	100	Gasoline	Unknown
108-3	550	Diesel Fuel	Unknown
120-1 ^(a)	55	Diesel Fuel	1980
120-2 ^(a)	55	Diesel Fuel	1980
215 ^(a)	275	Diesel Fuel	1971
220-1 ^(a)	275	Diesel Fuel	1981
220-2	1,000	Propane	Unknown
230	275	Diesel Fuel	1981
302-1	50,000	Water	Unknown
304 ^(a)	275	Diesel Fuel	1957
318 ^(a)	150	Diesel Fuel	1980
333	Unknown	Carbon Dioxide	Unknown
336	250	Diesel Fuel	Unknown
337-1	500	Diesel Fuel	Unknown
337-2	500	Diesel Fuel	Unknown
337-3	75,000	Water	Unknown
410 ^(a)	275	Diesel Fuel	1986
422 ^(a)	275	Diesel Fuel	Unknown
426 ^(a)	275	Diesel Fuel	1981
427 ^(a)	275	Diesel Fuel	1981
430 ^(a)	275	Diesel Fuel	1986
431-1	61	Propylene Glycol	Unknown
431-2	61	Propylene Glycol	Unknown
431-3	61	Hydraulic Fluid	Unknown
431-4	61	Hydraulic Fluid	Unknown
431-5	61	Mop Soap	Unknown
431-6	61	Oil	Unknown
431-7	61	Oil	Unknown
431-8	61	Oil	Unknown
431-9	300	Unknown	Unknown
436	15,000	Water	Unknown
501	275	Diesel Fuel	1986
502 ^(a)	275	Diesel Fuel	1986
511 ^(a)	275	Diesel Fuel	1986
521-1 ^(a)	250	Diesel Fuel	1989
521-2	61	Hydraulic Fluid	Unknown
521-3	61	Hydraulic Fluid	Unknown
521-4	61	Hydraulic Fluid	Unknown
521-6	61	Motor Oil	Unknown

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 2 of 4

Building	Capacity (gallons)	Content	Date of Installation
521-7	61	Motor Oil	Unknown
521-8	61	Motor Oil	Unknown
521-9	61	Motor Oil	Unknown
528	1,000	Propane	Unknown
531	275	Diesel Fuel	1986
533-1	100	Diesel Fuel	1992
533-2	61	Lube Oil	Unknown
533-3	61	Lube Oil	Unknown
533-4	61	Lube Oil	Unknown
533-5	61	Lube Oil	Unknown
533-6	61	Lube Oil	Unknown
533-7	61	Lube Oil	Unknown
533-8	61	Lube Oil	Unknown
533-9	61	Lube Oil	Unknown
543	275	Diesel Fuel	1981
603	100	Diesel Fuel	Unknown
604-1	300	Soap	Unknown
604-2	300	Soap	Unknown
610-1	61	Hydraulic Fluid	Unknown
610-2	61	Propylene Glycol	Unknown
610-3	61	Soap	Unknown
610-4	61	Motor Oil	Unknown
610-5	61	Motor Oil	Unknown
610-6	61	Motor Oil	Unknown
610-7	61	Motor Oil	Unknown
610-8	61	Motor Oil	Unknown
612	20	Diesel Fuel	Unknown
624	275	Diesel Fuel	1981
627-1	61	Cleaning Compound	Unknown
627-2	61	Soap	Unknown
627-3	61	Window Fluid	Unknown
627-4	61	Propylene Glycol	Unknown
627-5	61	Motor Oil	Unknown
627-6	61	Hydraulic Fluid	Unknown
627-7	61	Empty	Unknown
627-8	61	Empty	Unknown
627-9	12,655	Propylene Glycol	Unknown
627-10	12,655	Propylene Glycol	Unknown
627-11	10,000	Propylene Glycol	Unknown
642	1,000	Propane	Unknown
664	1,800	Aqueous Film-Forming Foam	Unknown

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 3 of 4

Building	Capacity (gallons)	Content	Date of Installation
670-1	500	Diesel Fuel	1987
670-2	500	Diesel Fuel	1987
670-3	500	Diesel Fuel	1987
708	150	Diesel Fuel	Unknown
709-1	400	Diesel Fuel	Unknown
709-2	400	Diesel Fuel	Unknown
709-3	400	Diesel Fuel	Unknown
709-4	400	Diesel Fuel	Unknown
709-5	61	Motor Oil	Unknown
709-6	61	Motor Oil	Unknown
709-7	61	Motor Oil	Unknown
709-8	61	Motor Oil	Unknown
709-9	61	Motor Oil	Unknown
709-10	61	Motor Oil	Unknown
709-11	61	Motor Oil	Unknown
709-12	61	Motor Oil	Unknown
712-1	275	Diesel Fuel	1986
712-2	275	Diesel Fuel	1986
712-3	100	Diesel Fuel	Unknown
715 ^(b)	200	Diesel Fuel	1979
716 ^(b)	200	Diesel Fuel	1979
717	300	Empty	Unknown
721 ^(b)	200	Diesel Fuel	Unknown
724 ^(b)	200	Diesel Fuel	Unknown
725	275	Diesel Fuel	1981
726	10	Diesel Fuel	Unknown
731	1,000	Propane	Unknown
732	1,000	Propane	Unknown
735	500	Propane	Unknown
822-1	1,000	Propane	Unknown
822-2	1,000	Propane	Unknown
824-1	1,000	Propane	Unknown
824-2	1,000	Propane	Unknown
833-1	275	Diesel Fuel	1986
833-2	275	Diesel Fuel	1986
833-3	275	Diesel Fuel	1986
833-4	1,000	Propane	Unknown
850-1	175	Diesel Fuel	Unknown
850-2	125	Diesel Fuel	Unknown
850-3	1,000	Propane	1976
850-4	1,000	Propane	1976
856-1	6,000	Aluminum Sulfate	1986

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 4 of 4

Building	Capacity (gallons)	Content	Date of Installation
856-2	6,000	Aluminum Sulfate	1986
870-1	50	Diesel Fuel	Unknown
870-2	500	Diesel Fuel	1991
872	1,000	Propane	Unknown
875	1,000	Propane	Unknown
5060 ^(a)	100	Diesel Fuel	Unknown
5062-1	5,000	Liquid Oxygen	Unknown
5062-2	2,000	Liquid Nitrogen	Unknown
5063-1	5,000	Liquid Oxygen	Unknown
5063-2	2,000	Liquid Nitrogen	Unknown
5151	500	Propane	Unknown
7008 ^(c)	5,000	Empty	1976
7009 ^(c)	5,000	Empty	1976
7015	840,000	JP-4	1956
7020 ^(c)	210,000	Diesel Fuel (Empty)	1956
7021	210,000	Propylene Glycol	1956
7023 ^(c)	420,000	JP-4 (Empty)	1956
7024	1,575,000	JP-4	1956
7038	500,000	Water	1956
7058	Unknown	Water	1967
7094	367,500	Diesel Fuel	1974
7095 ^(c)	367,500	Diesel Fuel (Empty)	1974

Notes: (a) A separate 10-gallon day tank associated with an emergency generator is also located at this facility.
 (b) Tank is attached to mobile emergency generator.
 (c) Inactive.

Table G-5. Inventory of Oil/Water Separators (as of March 30, 1994)

Building	Description	Capacity (gallons)	Waste Oil Capacity
438	Refueling Maintenance	2,500	6,000 ^(a)
530	Vehicle Maintenance	Unknown	500
608	Vehicle Maintenance	3,890	1,000
668	Fuel Cell Maintenance	500	Unknown
869	Sewage Treatment Plant	67,000	1,000 ^(a)
4005	Aircraft Maintenance	4,000	2,000
4008	Jet Engine Test Cell	550	1,000 ^(a)
4009	Integrated Maintenance Facility (WSA)	5,800	2,000 ^(a)
4010	Aircraft Support Equipment Shop/Storage Facility	12,000	2,000
4033	Refueling Vehicle Maintenance	20	1,000 ^(a)
4035	Weapons Training Maintenance	3,000	550
5065	Storm Drain Pump House	Unknown	Unknown
7083	Fire Training Area No. 2	Unknown	Unknown

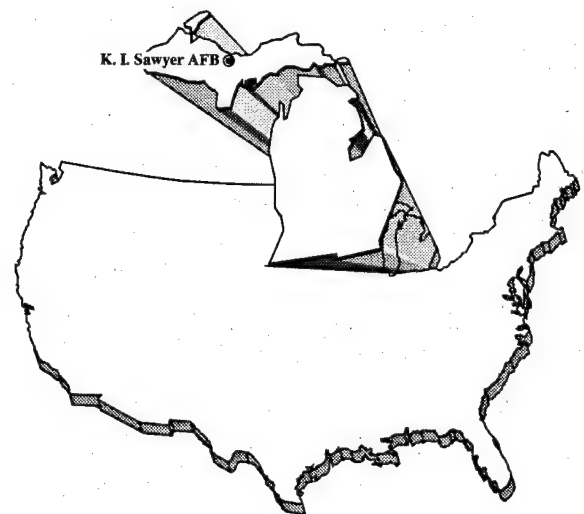
Note: (a) Wastes stored in separate underground storage tank associated with oil/water separator.
WSA = Weapons Storage Area

Table G-6. Pesticides Inventory

Name	Quantity
Pesticides	
Bay Gon	24 gallons
Combat	58 pounds
Cyno-Gas	5 pounds
Diazinon	6 gallons
Diazinon	12 pounds
Drione	70 pounds
Dursban	7 ounces
Dursban	20 pounds
Dursban	30 gallons
d-Trans Allethrin-Resm	13 gallons
d-Phenethrin	11 gallons
Ficam-W	6 pounds
Malathion	135 gallons
Malathion	130 gallons
Pyrenone	0.3 gallons
Tempo	1 gallon
Sevin	50 pounds
Sevin	225 pounds
PT-240 Perma Dust	95 pounds
PT-250 Baygon	122 pounds
PT-270 Dursban	180 pounds
PT-515 Wasp Freez	17 gallons
PT-565 Pyrethrum Plus	2 gallons
Killmaster II Dursban	3 gallons
Herbicides	
Trimec	19 gallons
Round-up	81 gallons
Simazine	50 pounds
2,4-D	44 gallons
Karmec	240 pounds
Weed & Feed Fertilizer	32,600 pounds ^(a)
Rodenticide	
Warfrin	100 pounds
Fungicides	
Daconil 2787	250 pounds
Tursan	56 pounds
Termec sp	252 pounds

Note: (a) Material stored at golf course maintenance facility.

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APPENDIX H

APPENDIX H

AIR FORCE POLICY FOR MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL AT CLOSURE BASES AND RESULTS OF K. I. SAWYER AIR FORCE BASE ASBESTOS SURVEY

APPENDIX H

AIR FORCE POLICY FOR MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM) AT CLOSURE BASES

This policy applies specifically to property being disposed of through the Base Realignment and Closure (BRAC) process and supersedes all previous policy on this matter.

1. REFERENCES

- a. Asbestos Hazard Emergency Response Act (AHERA).
- b. Federal Tort Claims Act, 28 U.S.C. § 2671.
- c. 40 CFR Part 61, Subpart M - National Emission Standards for Hazardous Air Pollutants (NESHAP).
- d. 29 CFR Section 1910.1001 - Occupational Safety and Health Administration (OSHA) general industry standard for asbestos.
- e. 29 CFR Section 1926.58 - Occupational Safety and Health Administration (OSHA) construction industry standard for asbestos.
- f. 40 CFR Part 302 - Designation, Reportable Quantities, and Notification.
- g. 41 CFR Section 101-47.304-13 - Federal Property Management Regulations provisions relating to asbestos.
- h. AFI 32-1052, Facility Asbestos Management.
- i. AFI 32-7066, Environmental Baseline Surveys in Real Estate Transactions.

2. DEFINITIONS

- a. **Asbestos** - A group of naturally occurring minerals that separate into fibers, including chrysotile, amosite, crocidolite, asbestiform anthophyllite, asbestiform tremolite, and asbestiform actinolite.
- b. **ACM** - Asbestos-Containing Material. Any material containing more than one percent asbestos.
- c. **Accredited Asbestos Professional** - Air Force Bioenvironmental Engineer or any other professional who is accredited through EPA's asbestos model accreditation plan or other equivalent method.

3. POLICY

The Air Force will ensure that at the time any property is conveyed, leased, or otherwise disposed of through the Base Realignment and Closure (BRAC) process, it does not pose a threat to human health due to ACM and that the property complies with all applicable statutes and regulations regarding ACM.

a. Responsibilities

- (1) The Air Force Base Conversion Agency (AFBCA) conducts and funds, from BRAC accounts, any asbestos surveys and remediation needed solely for base closure; to include, but not limited to, additional asbestos surveys for environmental baseline surveys, asbestos repair or resurvey of vacated buildings.
- (2) The MAJCOM's conduct and fund asbestos surveys and remediation needed to properly manage asbestos hazards, in accordance with current policy guidelines, up to the time of property management responsibility transfer to AFBCA.

b. Surveys for ACM. A survey of facilities for ACM will be accomplished or updated within the 6 months prior to the initial transfer, whether by lease, sale or other disposal method. Surveys will, at a minimum, identify the extent of asbestos contained in facilities and the exposure hazards. Surveys will be accomplished under the supervision of an accredited asbestos professional. These surveys will minimally include the following:

- (1) A review of facility records.
- (2) A visual inspection.
- (3) An intrusive inspection, as directed by an accredited asbestos professional.
- (4) Ambient air sampling, if directed by an accredited asbestos professional, in order to determine if any appropriate remedial actions are needed prior to the property being leased or transferred, or to protect facility occupants.

c. Remediation of ACM. Remediation of ACM in facilities at closure bases will be in accordance with applicable laws, regulations and standards. Remediation of ACM may be required if, in the judgment of an accredited asbestos professional, at least one of the following criteria apply:

- (1) The ACM is of a type, condition, and in a location such that, through normal and expected use of the facility, it will be damaged to the extent that it will produce an asbestos fiber hazard to facility occupants.
- (2) The type and condition of the ACM is such that it is not in compliance with appropriate statutes or regulations.

EXCEPTION: Remediation of ACM by AFBCA will not be accomplished if the transferee is willing to conduct remediation in accordance with applicable standards prior to beneficial occupancy as part of the transfer agreement.

- d. **Full Disclosure.** AFBCA will make a full disclosure to the extent known of the types, quantities, locations, and condition of ACM in any real property to be conveyed, leased, sold, or otherwise transferred. Results of ambient air sampling will also be disclosed where available. This disclosure will normally be included in appraisal instructions, invitations for bids or offers to purchase, advertisements and contracts for sale, leases, and deeds.
- e. **Management of ACM.** ACM remaining in a facility will be managed in-place using commonly accepted standards, criteria, and procedures in compliance with all applicable laws and regulations to assure the protection of human health and the environment. The responsibility for this management will be transferred to the owner or lessee by execution of the appropriate documents.

4. EFFECTIVE DATE

This policy becomes effective on the date signed and remains in effect until superseded.

/s/ _____
Alan P. Babbitt
Acting Deputy Assistant Secretary of the Air Force
(Environment, Safety, and Occupational Health)

3/25/94
Date

This Air Force Policy for Management of Asbestos Containing Material (ACM) at Closure Bases, March 25, 1994, supersedes previous Air Force Policy on management of asbestos dated November 6, 1990, and May 1, 1992, respectively, and has been retyped for purposes of clarity and legibility.

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 1 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
104	Readiness Crew	No ACM identified
108	Readiness Crew Facility	Albatros underground pipe, flex duct material on furnace
112	Fire Station	No ACM identified
113	Rescue Fire Facility	Roof - asphalt and gravel. Shop area - vinyl composite floor tile
310	Entry Control Facility	Mechanical Room - cold water fitting, hot water piping and fitting, venting duct. Shack - hot water piping, vinyl floor tile. Roof - asphalt and gravel
311	Survival Inspection Shop	Boiler insulation. Domestic cold water pipe suspect due to both positive and negative results of samples taken
317	Rescue Fire Facility	Pool - vinyl composite floor tile. Roof - asphalt and gravel
319	Warehouse Supply	Mechanical Room - hot water fitting. Hot water fitting, vinyl composite floor tile
321	Conventional Munitions Shop	Bomb Room - hot water fitting. Mechanical Room - hot water fitting. Office - hot water fitting. Roof - asphalt and gravel
400	Weapon and Release System Shop	Volk field - pipe insulation (first floor store room). Wall board material. Mechanical room - pipe insulation, hot water converter. Wall sheetrock suspect due to both positive and negative sample results
402	Storage Facility	Mechanical room - pipe insulation. Maintenance bay - pipe insulation. Hot water heating fitting suspect due to both positive and negative sample results
404	Lab/Education Center/Group Headquarters	Grey and brown floor tile. Mechanical room - duct insulation, pipe insulation, high temperature water pipe, insulation, make up water pipe insulation. HVAC system - duct surface suspect due to both positive and negative sample results
405	Maintenance Shop	Store room - Vinyl composite floor tile
406	Operations Building	Mechanical room - pipe insulation
408	Maintenance Shop	Vinyl composite floor tile, mechanical equipment tank, vent duct, hot water fitting

HVAC = heating, ventilating, and air conditioning

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 2 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
409	Warehouse	Mechanical room - pipe insulation. Radiator pipe insulation - midline of pipeline, pipe elbow by radiator. Ceiling sheetrock suspect due to both positive and negative sample results.
414	Maintenance Shop	Mechanical room - pipe insulation. Basement - duct insulation (near work area)
417	Warehouse Supply	Sheetrock, ceiling tile, vinyl composite floor tile
419	Warehouse Supply	No ACM identified
420	Explosive Ordnance Disposal Facility	Office - vinyl composite floor tile. Maintenance Bay - vinyl composite floor tile
421	Storage Facility	Pipe insulation, joints, fittings, and elbows, radiator line (near ceiling). Mechanical room - hot water converter line insulation. Exterior electric section - pipe insulation
422	Vehicle Operations	Maintenance Bay - hot water fitting. Mechanical Room - hot water piping and fittings, tank. East Office - vinyl composite floor tile, hot water fitting. Office West - vinyl composite floor tile, hot water fitting. Roof - asphalt and gravel, shingled. Vinyl composite floor tile
424	Maintenance Shop	Hot water heating piping suspect due to both positive and negative sample results
425	Hangar	Maintenance Bay - hot water fitting. Roof - asphalt and gravel
426	Security Police Operations	Mechanical room - wall insulation, hot water converter insulation. Small store room - hot water system insulation. Second floor - northwest corner floor tile. Domestic water fitting insulation and wall sheetrock suspect due to both positive and negative sample results
427	Base Operations	Mechanical room - hot water converter insulation, hot water line insulation, vent duct insulation. Communications room - wallboard
428	Survival Equipment Shop	Mechanical room - pipe insulation. Glued on wall tile and wall sheetrock suspect due to both positive and negative sample results
430	Survival Equipment Shop	Mechanical room - pipe insulation
431	Storage Facility	Pipe insulation (ceiling area by wash section). Mechanical room - high temperature hot water line insulation

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 3 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
500	Wing Headquarters	Hot water heating fitting suspect due to both positive and negative sample results
501	Communication Facility	Pipe cloth suspect due to both positive and negative sample results
502	Field Training Facility	Mechanical room - hot water line pipe insulation, ceiling tile
503	Chapel Center	Volk field - pipe insulation (Machine Shop). Office - radiator line insulation. Above kitchen area. Domestic water pipe insulation suspect due to both positive and negative sample results
504	Recreation Center	No ACM identified
511	Security Police Operations/ Corrections Facility	Mechanical room - insulation. Office - radiator line insulation
512	Base Personnel Office	Duct insulation
513	Miscellaneous Facility	Office - Vinyl composite floor tile. Roof - shingled
520	Pump Station	Insulation
522	Supply and Equipment Warehouse	Warehouse - pipe insulation (above door), pipe insulation (ceiling heat unit). Steam fitting suspect due to both positive and negative sample results
530	Vehicle Maintenance Shop	Locker room - pipe insulation
531	Base Engineering	Heating/ventilation unit, hot water line. Mechanical room - pipe. Drafting section - radiator line insulation. Planning office - pipe insulation
533	Pavement Ground Facility	Mechanical room - insulation
535	Education Center	Roof - shingled
537	Education Center	Vinyl composite sheet floor. Roof - shingled
538	Education Center	Vinyl composite sheet floor. Roof - shingled
539	Education Center	Vinyl composite sheet floor. Roof - rolled sheet type
600	Fire Station	Pipe insulation, fill hose water line, stall #1 pipe insulation. Mechanical room - hot water line (by right side floor pump), small hot water tank. Hot water heating piping suspect due to both positive and negative sample results
601	Photo Lab	Mechanical room - pipe insulation
603	Utility Vault	Roof - asphalt and gravel

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 4 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
604	Vehicle Operations	Pipe insulation. Domestic cold water pipe suspect due to both positive and negative sample results
607	Vehicle Operations	Wall sheetrock and vinyl composite sheet floor suspect due to both positive and negative sample results
608	Vehicle Maintenance	No ACM identified
609	Vehicle Shop	Pipe line (garage area). Mechanical room - pipe insulation, hot water distribution line. Latrine - pipe insulation. Utility room - pipe insulation. Domestic water pipe insulation suspect due to both positive and negative sample results
610	Storage Facility	Hot water converter. Mechanical room - pipe insulation. Maintenance bay (over offices) - pipe insulation. Hot water heating fitting suspect due to both positive and negative sample results
611	Security Police	Weapon Storage Area - floor tiles. Hot water heating piping suspect due to both positive and negative sample results
631	Commissary	Pipe insulation, refrigeration suction line, domestic hot water line. Domestic water pipe insulation suspect due to both positive and negative sample results
632	Exchange	Pipe insulation. Wall sheetrock suspect due to both positive and negative sample results
633	Clothing Store	Mechanical room - pipe insulation
634	Commissary	Pipe insulation (near water fountain). Boiler room - insulation. Locker room (men's) - pipe insulation. Wall plaster suspect due to both positive and negative sample results
640	Non-Commissioned Officers' Mess	Mechanical room - hot water line insulation. Vent duct insulation (above ceiling tile)
641	Gymnasium	Hot water line pipe insulation, hot water return line pipe insulation, radiator pipe insulation. Mechanical room - pipe insulation. Domestic water pipe insulation suspect due to both positive and negative sample results
642	Bowling Center	Glued on wall tile suspect due to both negative and positive sample result
661	Maintenance Dock	Wall sheetrock suspect due to both positive and negative sample results
662	Maintenance Dock	Office - vinyl composite floor tile

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 5 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
663	Maintenance Dock	Maintenance Bay - hot water fitting. Office - vinyl composite floor tile. Hot water fittings
665	Maintenance Dock	Hot water heating piping suspect due to both positive and negative sample results
666	Maintenance Dock	Maintenance Bay - hot water fitting. Office - vinyl composite floor
667	Corrosion Control Facility	Maintenance Bay - hot water piping and fittings. Office - vinyl composite floor
668	Maintenance Dock	Venting duct, hot water fittings, heat exchanger. Roof - asphalt and gravel. Shop - vent duct, hot water piping and fittings
708	Communication Facility	Floor tile (Room 129), wall panels, hot water line pipe insulation, vent duct insulation, duct insulation (at seam, 2nd floor), white floor tile (back of old rapid repro), red/brown floor tile (back of rapid repro), cream color floor tile (hall), floor tile (Room 317), pegboard (Room 317), ceiling tile, cool water pipe insulation, water coolers outside building. Utility room - air conditioning/heating unit insulation. Mechanical room (3rd floor) - "J" air conditioning/heating system, "F" supply fans, ceiling board, air handler seams. Mechanical room (2nd floor) - duct insulation. Drain-piping system and domestic cold water pipe suspect due to both positive and negative sample results
709	Electrical Power Station	Insulation on stack of retired boiler, pipe insulation in basement (near work area), duct insulation in basement (near work area), pipe insulation (near roll door, east wall), pipe insulation for backup generator, pipe insulation to unit heater, boiler line, pipe insulation to chemical additive unit, mech/boiler room. Duct suspect due to both positive and negative sample results
710	Squadron Operations/Legal Center	Piece of ground pipe in front of building. Heating/ventilation room - insulation. Mechanical room - pipe insulation. Wall plaster suspect due to both positive and negative sample results

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992

Page 6 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
725	Aircraft General Purpose Shop	Brown and cream tile in women's latrine, duct insulation overtop of air compressors, pipe insulation, floor tile and adhesive in electrical hallway, wallboard, floor tiles (old records staging area). Mechanical room - insulation, heating/ventilation elbow, joint fitting, vent insulation, ceiling tile. Hot water heating fitting, domestic water pipe insulation, ceiling sheetrock, and ceiling tile suspect due to both positive and negative sample results
726	Headquarters Wing	No ACM identified
727	Supply and Equipment Warehouse	Mechanical room - insulation, vent duct insulation, raw water line pipe insulation, ceiling insulation. Office - pipe insulation. Hot water heating piping suspect due to both positive and negative sample results
730	Squadron Operations	Airjets in refrigeration shop, air movement system - vent duct insulation, ceiling tile (bay area), hot water line insulation by exit door, air movement system - air handler duct. Mechanical room - insulation, air handler insulation
740	Jet Engine Maintenance	Vent duct insulation (south end of building), pipe insulation (main bay, west end of building)
741	Flight Simulator	Mechanical room - boiler/heater exchange, pipe insulation
800	Officers' Open Mess	Mechanical room - pipe insulation. Pipe insulation behind ice machine. Heat exchanger (mechanical equipment) and domestic water pipe insulation suspect due to both negative and positive sample results
801	Dormitory	Hot water converter. Hot water heating fitting and wall sheetrock suspect due to both positive and negative sample results
802	Visiting Officers' Quarters	Radiator line insulation. Floor tile beneath carpet
803	Officers' Quarters	Pipe insulation (Billeting Room). Room 10 - pipe insulation. Floor tile beneath carpet. Room 3502 - pipe insulation
805	Officers' Quarters	Insulation (hot water converter), pipe insulation. Mechanical room - asbestos material on floor, boiler insulation
810	Dormitory	Pipe insulation (hot water converter), pipe insulation (radiator)

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 7 of 8

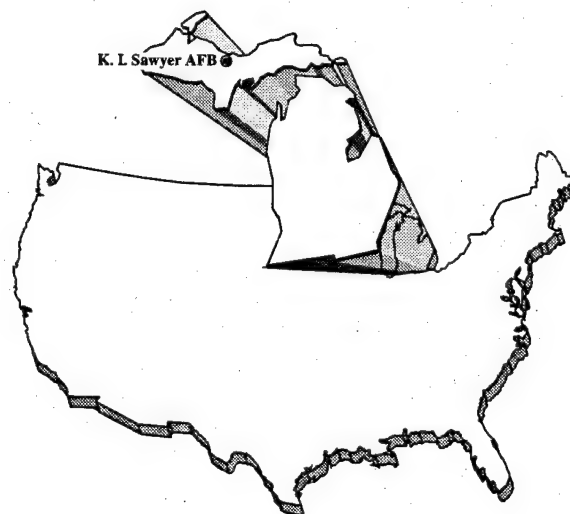
Building	Facility Description	Asbestos-Containing Material (ACM) Present
811	Dormitory	Pipe insulation (2nd floor near exit). Mechanical room - pipe insulation (hot water supply line), boiler insulation. Hot water heating piping suspect due to both positive and negative sample results
813	Post Office	No ACM identified
814	Airmen's Dormitory	No ACM identified
815	Dormitory	Mechanical room - pipe insulation
816	Animal Clinic	Mechanical room - pipe insulation
817	Social Action Facility	Mechanical room - pipe insulation
819	Theater	Mechanical room - insulation. Mechanical room - pipe insulation. Mechanical room - air handler insulation. Hot water heating piping and textured acoustical ceiling suspect due to both positive and negative sample results
822	Package Storage	No ACM identified
824	Automotive Shop	Soffit on north end of building
825	Arts and Crafts Center	Roof - asphalt and gravel
826	Service Station	Hot water heating fitting suspect due to both positive and negative sample results
830	Dormitory	Mechanical room - high temperature hot water line insulation. Mechanical room - boiler insulation
831	Dormitory	Mechanical room - pipe insulation
832	Dormitory	Pipe insulation (hot water converter)
833	Dining Hall	Radiator line insulation. 2nd floor - pipe insulation. Mechanical room - pipe insulation. Dining hall - duct insulation. Masonite board from building exterior
835	Dormitory	Mechanical Room - hot water piping and fittings, tank. Rooms - vinyl composite floor. Roof - shingled
836	Dormitory	Mechanical Room - hot water piping and fittings, tank. Rooms - vinyl composite floor. Roof - shingled
837	Group Headquarters	Mechanical room - pipe insulation

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 8 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
850	Medical Composite	Old mechanical room - pipe insulation. Surgery - seamline to vent #3, vent run #3 insulation. Basement - pipe insulation. Surgical nurses station - floor tile. Dental clinic - vinyl floor tile. Steam fitting suspect due to both positive and negative sample results
852	Material Services	No ACM identified
863	Wastewater Treatment Facility	No ACM identified
864	Waste Treatment Facility	Roof - asphalt and gravel
869	Waste Treatment Facility	Vinyl composite floor. Roof - asphalt and gravel
875	Golf Course and Equipment Storage	No ACM identified
947	Youth Center	Radiator pipe insulation. Unknown room - pipe insulation
948	Child Care Center	Roof tile. Mechanical room - boiler/heater exchange
1015	Miscellaneous Building	Vinyl composite floor, venting ducts. Roof - rolled sheet type
1020	Family Housing	Hot water fittings crawl space, sheet rock in walls and ceiling
1200	Transient Lodging Facility	Vinyl composite floor. Roof - shingled
1201	Transient Lodging Facility	Vinyl composite floor. Roof - shingled
1204	Family Sports Center	Vinyl composite floor. Roof - shingled
1211	Red Cross Office	Roof - shingled
1246	Maintenance Shop	Vinyl composite floor, vent duct
1247	Branch Exchange	Vent duct, vinyl composite floor. Roof - asphalt and gravel
1249	Thrift Shop	Vinyl composite floor. Roof - shingled
1250	Chapel	No ACM identified
1375	Youth Center	Mechanical room - boiler/heater exchange
912-1966	Family Housing Units	Each unit type sampled, 78 total units. Each unit contained ACM. Specific records for each facility is available at Civil Engineering

Note: Data for Table H-1 compiled from Galson's 1992 and 1994 asbestos surveys. Results of other asbestos surveys conducted by base personnel for building modification are available from Civil Engineering. These base surveys may not include an entire facility, only portions to be modified.

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APPENDIX I

APPENDIX I

**AIR QUALITY ANALYSIS METHODS AND
AIR EMISSIONS INVENTORY FOR K. I. SAWYER AIR FORCE BASE**

APPENDIX I

AIR QUALITY ANALYSIS METHODS AND AIR EMISSIONS INVENTORY FOR K. I. SAWYER AIR FORCE BASE

CONSTRUCTION EMISSIONS

Construction activities would generate combustive emissions from heavy equipment usage and fugitive dust emissions from ground disturbing activities. Fugitive dust would be generated during construction activities associated with airfield, aviation support, industrial, institutional, commercial, residential, and public facilities/recreation land uses. These emissions would be greatest during site clearing and grading. Uncontrolled fugitive dust (particulate matter) emissions from ground-disturbing activities are emitted at a rate of 1.2 tons per acre per month, or 110 pounds per acre per day (U.S. Environmental Protection Agency, 1985). The particulate matter equal to or less than 10 microns in diameter (PM₁₀) portion of fugitive dust emissions is assumed to be 50 percent, or 55 pounds per acre per working day (acre-day).

Construction for the Proposed Action would disturb a total of approximately 171 acres over the first 5-year period of activity (1995-2000). Assuming that disturbance of the area occurs at the same rate throughout this period, an average of 34.2 acres per year would be disturbed. The analysis of fugitive dust emissions from construction activities assumes an average of 230 working days per year (accounting for weekends, weather, and holidays), and that half of these days (115) would be used for site preparation. Additionally, 4 acre-days of disturbance are assumed per acre. Thus, for the Proposed Action during 1995-2000, the PM₁₀ emissions are calculated as follows:

Average daily disturbed acreage:

$$\frac{34.2 \text{ acres disturbed}}{\text{year}} \times \frac{4 \text{ acre-days of disturbance}}{\text{acre}} \times \frac{1 \text{ year}}{115 \text{ days}} = 1.19 \text{ acres}$$

Average daily PM₁₀ emissions:

$$1.19 \text{ acres} \times \frac{55 \text{ pounds PM}_{10}}{\text{acre-day}} = \frac{65.4 \text{ pounds PM}_{10}}{\text{day}} = \frac{0.033 \text{ ton PM}_{10}}{\text{day}}$$

Total annual PM₁₀ emissions:

$$\frac{65.4 \text{ pounds PM}_{10}}{\text{day}} \times \frac{115 \text{ days}}{\text{year}} \times \frac{\text{ton}}{2,000 \text{ pounds}} = 3.76 \text{ tons/year}$$

Therefore, the amount of PM₁₀ emitted would be 65.4 pounds per day (0.033 ton per day) for 1995-2000. These emissions would produce elevated short-term PM₁₀ concentrations, would be temporary, and would fall off rapidly with distance from the source. Similar calculations for fugitive dust emissions were performed for construction activities related to other alternatives. The results of these PM₁₀ fugitive dust calculations are summarized in Table I-1. (All tables are at the end of this appendix.)

Construction combustive emissions are estimated using the following pound-per-acre emission factors developed for a medium-scaled construction scenario that includes site preparation, new facility construction, and related infrastructure development.

Pollutant	Pounds Per Acre
Nitrogen oxides (NO _x)	1,095
Carbon monoxide (CO)	3,820
Sulfur oxides (SO _x)	100
PM ₁₀	85
Volatile organic compounds (VOCs)	290

Construction combustive emissions associated with each alternative are summarized by time period in Table I-1. Since construction equipment is assumed to be active 230 days per year, annual emissions are equal to daily emissions multiplied by 230.

AIRCRAFT OPERATION EMISSIONS

Emissions for the following aircraft activities were calculated from fleet mix and operational information inherent to each alternative: idling at gates, runway climb and approach, taxi-in and taxi-out, touch and go, runway queuing, takeoffs and landings, and engine run-ups. All aircraft emissions were calculated with the Emissions and Dispersion Modeling System (EDMS) model (Segal, 1988a, 1988b, and 1991), which contains a built-in database of U.S. Environmental Protection Agency (EPA) AP-42 emission factors for various types of aircraft. EDMS was also used to calculate downwind pollutant concentrations that would occur from aircraft operations associated with each alternative. Aircraft operation emissions are summarized in Table I-2.

MOTOR VEHICLE EMISSIONS

Motor vehicle emissions were estimated using emission factors from MOBILE 5.0A, the average number of daily trips generated, and the average daily vehicle miles traveled (VMT). MOBILE 5.0A is the latest version of the U.S. EPA-approved model used to estimate emission factors for on-road mobile sources. For preclosure conditions, VMT for the military fleet was estimated

from fuel use records, while VMT for civilian vehicles was based on the number of employees and an assumption of 30 miles per day round-trip travel. A similar assumption of 30 miles per vehicle per day was used for closure conditions. For reuse-related alternatives, the U.S. EPA default values for vehicle mileage mix, tampering rates, mileage accumulation, and exhaust emission rates were used. In addition, the lack of Stage II vapor recovery systems and vehicle anti-tampering and inspection and maintenance programs in the state of Michigan were taken into account. The monthly averages of daily minimum and maximum temperature were averaged for the four quarters of the year. These quarterly averages were used to correct emission factors on a quarterly basis. To estimate the mileage, it was assumed that each one-way vehicle trip associated with a reuse alternative was an average of 15 miles. A summary of the mobile source emissions is presented in Table I-3 for preclosure, closure, and reuse alternative conditions.

OTHER BASE AND/OR REUSE OPERATIONS EMISSIONS

Emissions from sources other than construction activities, aircraft operations, or motor vehicles can be lumped together and called "Other Operation Emissions." These Other Operation Emissions occur from a variety of point and area sources.

The only emissions data available from the state of Michigan for Marquette County were for point sources. Some area and mobile source data are available from U.S. EPA's Graphical Aerometric Data System (EGADS); however the data are incomplete. Approximately 98.5 percent of estimated NO_x , CO, sulfur dioxide (SO_2), PM_{10} , and VOC emissions in the Marquette County point source emissions database can be attributed to four sources: Marquette Board of Light and Power, Wisconsin Electric Power Company, Tilden Magnetite Partnership, and Empire Iron Mining Partnership. The first two sources are power production companies, while the last two are mining companies. K. I. Sawyer AFB contributes 1.38 percent of the emissions found in the point source emissions database. Emissions from the remaining 0.12 percent of sources are negligible when compared to the four major sources. Because a disproportionate amount of point source emissions comes from four sources, and because of the lack of area source emissions data for Marquette County, per capita emission factors could not be used to estimate point and area source emissions that would be associated with the operational phase of the reuse alternatives. However, it was assumed that reuse-related point and area source emissions would be less than the sum of the preclosure base emissions since fewer direct employees are associated with each reuse alternative (see Table I-4). The Proposed Action employment total in 2005 is only 3,551 for this comparison. The 1,563 employees associated with the heavy industrial land use are not included since point and area source emissions of heavy industrial land use are calculated separately as discussed in the next section.

It was also assumed that under the Proposed Action, International Wayport, and Commercial Aviation alternatives, the quantity and type of fuel consumption and processing for the existing heating plant would remain unchanged from preclosure operation levels. Under the Recreation Alternative, the heating plant would be converted to an electric generating facility. It was assumed that fuel use for the electric generating facility would be comparable to the existing heating plant, or that the facility would be converted to natural gas. No other major stationary sources are expected to be associated with the reuse alternatives.

HEAVY INDUSTRIAL LAND USE EMISSIONS - PROPOSED ACTION

Emissions from the heavy industrial land use area planned as part of the Proposed Action were calculated separately since these emissions would be potentially significant in magnitude. An indicator-based emission factor was developed from data contained in EGADS for industry types found in the state of Michigan. EGADS is a PC-based data retrieval program containing point source data from U.S. EPA's Aerometric Information Retrieval System (AIRS) and point, area, and mobile source data from U.S. EPA's 1990 Interim Emissions Inventory.

Per-employee point source emission factors were developed from data available for industry sources by summing the reported emissions and dividing by the total number of employees associated with the industries. It was assumed that the resulting per-employee factors could be multiplied by the estimate by employee for the Proposed Action heavy industrial land use area to provide reasonable estimates of the Proposed Action heavy industrial land use point source emissions. The point source emission factors and calculated emissions are presented in Table I-5. No point source data were reported in EGADS for PM₁₀. It is assumed that future PM₁₀ point source emissions associated with the Proposed Action heavy industrial land use area will be well controlled and negligible in magnitude.

Area and off-road mobile source emissions associated with the Proposed Action heavy industrial land use area were also calculated from information contained in the EGADS database. Per-employee area/off-road mobile source emission factors were developed by summing the area/off-road mobile source emissions data reported for all Standard Industrial Classification (SIC) codes representative of industry in the state of Michigan and dividing by the total number of employees associated with these industries. The major emission source types considered in this manner included stationary fuel combustion, off-highway vehicles, food production, wood products, various industrial processes, surface coating operations, degreasing, solvent use for various industries, bulk petroleum storage, and on-site incineration and waste burning. The area/off-road mobile source emission factors and calculated emissions are presented in Table I-5. No area/off-road mobile source data were reported in EGADS for SO₂ or PM₁₀.

It is assumed that future SO₂ and PM₁₀ area and off-road mobile source emissions associated with the Proposed Action heavy industrial land use will be negligible in magnitude.

EMISSIONS SUMMARY

Compared to preclosure conditions, the number of jobs at K. I. Sawyer AFB would decrease under the various reuse scenarios (excludes employees associated with the Proposed Action heavy industrial land use). Therefore, the point and area source emissions associated with each reuse alternative were assumed to be less than the preclosure point and area source emissions from K. I. Sawyer AFB. As such, the emissions from sources other than construction activities, aircraft operations, and mobile sources were not calculated for the reuse alternatives. Instead, as a conservative assumption for the Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative, the emissions of point and area sources other than construction, aircraft, and mobile sources were assumed to be the same as during preclosure at the base. The same assumption was used for the Recreation Alternative except that Aerospace Ground Equipment emissions were not included. For closure conditions, heating and power production emissions were assumed to be approximately 20 percent of preclosure levels. Point and area source emissions associated with the Proposed Action heavy industrial land use were calculated separately.

The sum of the construction, aircraft operation, motor vehicle, and other operation emissions (including heavy industrial land use area emissions for the Proposed Action) was evaluated to determine how the emissions would affect continued maintenance of the National Ambient Air Quality Standards (NAAQS). The summations of pollutant emissions are presented for preclosure, closure, and each reuse alternative in Tables I-6 through I-10 for nitrogen dioxide (NO₂), CO, SO₂, PM₁₀, and VOCs, respectively.

Table I-1. Construction Emissions Associated with All Alternatives (tons/day)

Pollutant	Source	Proposed Action ^(a)		International Wayport Alternative ^(b)		Commercial Aviation Alternative ^(c)		Recreation Alternative ^(d)		No-Action Alternative ^(e)	
		2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
NO ₂	Combustive Emissions	0.081	0.081	0.075	0.022	0.113	0.003	0.047	0.047	0.000	0.000
CO	Combustive Emissions	0.284	0.282	0.261	0.078	0.394	0.012	0.164	0.164	0.000	0.000
SO ₂	Combustive Emissions	0.007	0.007	0.007	0.002	0.010	0.000	0.004	0.004	0.000	0.000
PM ₁₀	Combustive Emissions	0.006	0.006	0.006	0.002	0.009	0.000	0.004	0.004	0.000	0.000
	Fugitive Dust Emissions	0.033	0.033	0.030	0.009	0.045	0.001	0.019	0.019	0.000	0.000
VOC	Combustive Emissions	0.022	0.021	0.020	0.006	0.030	0.001	0.012	0.012	0.000	0.000

Notes:

- (a) Proposed Action emissions based on a total disturbance area of 171 acres during 1995-2000, and 170 acres during 2000-2005.
 (b) International Wayport Alternative emissions based on a total disturbance area of 157 acres during 1995-2000, and 47 acres during 2000-2005.
 (c) Commercial Aviation Alternative emissions based on a total of 237 acres disturbed by construction during 1995-2000, and 7 acres disturbed during 2000-2005.
 (d) Recreation Alternative emissions based on a total disturbance area of 99 acres during 1995-2000, and 98 acres disturbed during 2000-2005.
 (e) No-Action Alternative emissions based on no land being disturbed during 1995-2000 and 2000-2005.
- CO = carbon monoxide
 NO₂ = nitrogen dioxide
 PM₁₀ = particulate matter equal to or less than 10 microns in diameter
 SO₂ = sulfur dioxide
 VOC = volatile organic compound

Table I-2. Aircraft Operation Emissions (tons/day)
Page 1 of 2

Pollutant	Source	Preclosure 1992	Closure 1995	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative	
				2000	2005	2000	2005	2000	2005
NO ₂	Aircraft Flying Operations								
	Military	0.340	0.00	0.001	0.001	0.001	0.001	0.000	0.000
	Civilian	0.001	0.00	0.147	0.159	0.438	0.931	0.011	0.013
	Aircraft Ground Operations								
	Military	0.251	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.000	0.000	0.018	0.039	0.000	0.000
	Total Aircraft Operations	0.592	0.00	0.148	0.160	0.457	0.971	0.011	0.013
	Aircraft Flying Operations								
CO	Military	1.757	0.00	0.011	0.011	0.011	0.011	0.000	0.000
	Civilian	0.010	0.00	0.750	0.877	0.771	1.296	0.663	0.776
	Aircraft Ground Operations								
	Military	1.196	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.001	0.002	0.006	0.014	0.000	0.000
	Total Aircraft Operations	2.963	0.00	0.762	0.890	0.788	1.321	0.663	0.776
	Aircraft Flying Operations								
	Military	0.037	0.00	0.000	0.000	0.000	0.000	0.000	0.000
SO ₂	Civilian	0.000	0.00	0.007	0.008	0.018	0.037	0.002	0.003
	Aircraft Ground Operations								
	Military	0.026	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.000	0.000	0.000	0.001	0.000	0.000
	Total Aircraft Operations	0.063	0.00	0.007	0.008	0.018	0.038	0.002	0.003

Table I-2. Aircraft Operation Emissions (tons/day)
Page 2 of 2

Pollutant	Source	Preclosure 1992	Closure 1995	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative	
				2000	2005	2000	2005	2000	2005
PM ₁₀	Aircraft Flying Operations								
	Military	0.413	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.013	0.015	0.011	0.023	0.011	0.012
	Aircraft Ground Operations								
	Military	0.027	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Total Aircraft Operations	0.440	0.00	0.013	0.015	0.011	0.023	0.011	0.012
VOC	Aircraft Flying Operations								
	Military	1.249	0.00	0.002	0.002	0.002	0.002	0.000	0.000
	Civilian	0.001	0.00	0.082	0.089	0.052	0.187	0.066	0.073
	Aircraft Ground Operations								
	Military	0.771	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.001	0.001	0.001	0.002	0.000	0.000
	Total Aircraft Operations	2.021	0.00	0.085	0.092	0.055	0.191	0.066	0.073

CO = carbon monoxide
 NO₂ = nitrogen dioxide
 PM₁₀ = particulate matter equal to or less than 10 microns in diameter
 SO₂ = sulfur dioxide
 VOC = volatile organic compound

Table I-3. Mobile Source Emissions (tons/day)

Alternative	Year	NO _x	CO	VOC
Preclosure				
Civilian	1992	0.311	2.319	0.216
Military (Gas)	1992	0.020	0.156	0.014
Military (Diesel)	1992	0.013	0.005	0.001
Total		0.344	2.480	0.231
Closure	1995	0.003	0.024	0.002
Proposed Action				
2000	2000	0.246	1.701	0.169
2005	2005	0.450	2.982	0.295
International Wayport				
2000	2000	0.397	2.742	0.272
2005	2005	0.528	3.501	0.346
Commercial Aviation				
2000	2000	0.202	1.399	0.139
2005	2005	0.337	2.232	0.221
Recreation				
2000	2000	0.072	0.499	0.049
2005	2005	0.116	0.767	0.076
No-Action				
2000	2000	0.003	0.024	0.002
2005	2005	0.003	0.022	0.002

Note: SO₂ and PM₁₀ emissions from mobile sources are negligible.

CO = carbon monoxide

NO_x = nitrogen oxides

VOC = volatile organic compound

Table I-4. Emission Indicators Associated with K. I. Sawyer AFB

Indicator	Preclosure		Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
	1992	1995	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Direct Employment	4,567	50	50	2,718 ^(b)	5,114 ^(c)	1,539	2,386	1,085	1,700	405	631	50	50
Site-Related Population	15,485 ^(a)	183 ^(a)	183 ^(a)	14,176	27,800	7,543	12,226	5,410	8,729	1,719	2,774	183	183
24-Hour Traffic VMT ^(d)	145,710	1,500	1,500	133,200	258,480	214,770	303,480	109,575	193,485	39,045	66,495	1,875	1,875
Aircraft LTOs													
Daily	52	0	0	49	55	53	88	44	50	0	0	0	0
Peak Hour	5	0	0	5	5	5	9	4	5	0	0	0	0
Aircraft Touch-and-Gos													
Daily	96	0	0	15	17	9	11	14	16	0	0	0	0
Peak Hour	14	0	0	1	2	1	1	1	2	0	0	0	0

Notes: (a) Does not include retired military.

(b) Includes 781 employees associated with heavy industrial land use.

(c) Includes 1,563 employees associated with heavy industrial land use.

(d) Assumes an average one-way vehicle trip length of 15 miles.

LTO = landing and takeoff

VMT = vehicle miles traveled

Table I-5. Heavy Industrial Land Use Emissions Associated with the Proposed Action

Heavy Industrial Land Use Category	Year	Employees	VOCs	NO _x	CO	SO ₂	PM ₁₀
Point Sources; ^(a) tons/year	NA	585,975	32,926	10,214	41,587	7,166	ND
Per Employee Point Source Factor; tons/employee/year	NA	NA	0.05619	0.01743	0.07097	0.01223	--
Area/Off-Road Mobile Sources; ^(b) tons/year	NA	585,975	140,622	37,801	32,029	ND	ND
Per Employee Area/Off-Road Mobile Source Factor; tons/employee/year	NA	NA	0.23998	0.06451	0.05466	--	--
Proposed Action Point Source Emissions; tons/year	2000	781	43.90 (0.12)	13.60 (0.04)	55.40 (0.15)	9.60 (0.03)	--
(tons/day)	2005	1,563	87.80 (0.24)	27.20 (0.07)	110.90 (0.30)	19.10 (0.05)	--
Proposed Action Area/ Off-Road Mobile Source Emissions; tons/year	2000	781	187.40 (0.51)	50.40 (0.14)	42.70 (0.12)	--	--
(tons/day)	2005	1,563	375.10 (1.03)	100.80 (0.28)	85.40 (0.23)	--	--
Total Proposed Action Emissions; tons/year	2000	781	231.30 (0.63)	64.00 (0.18)	98.10 (0.27)	9.60 (0.03)	--
(tons/day)	2005	1,563	462.90 (1.27)	128.00 (0.35)	196.30 (0.53)	19.10 (0.05)	--

Notes: (a) Point source emissions are based on data available from the U.S. EPA's Graphical Aerometric Data System (EGADS) for industries in the state of Michigan.
(b) Area/off-road mobile source emissions are based on data available from EGADS for all Standard Industrial Classification (SIC) codes typical of industry in the state of Michigan.

NA = not applicable
ND = no data
CO = carbon monoxide
NO_x = nitrogen oxides
PM₁₀ = particulate matter equal to or less than 10 microns in diameter
SO₂ = sulfur dioxide
VOC = volatile organic compound

K. I. Sawyer AFB Disposal FEIS

Table I-6. K. I. Sawyer AFB - Emissions Inventory for Nitrogen Oxides (tons/day)

Source	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
			2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	0.592	0.000	0.148	0.160	0.457	0.971	0.011	0.013	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.081	0.081	0.075	0.022	0.113	0.003	0.047	0.047	0.000	0.000
Motor Vehicle	0.344	0.003	0.246	0.450	0.397	0.528	0.202	0.337	0.072	0.116	0.003	0.003
Other Operation Sources	0.295	0.038	0.475 ^(a)	0.645 ^(b)	0.295	0.295	0.295	0.295	0.190	0.190	0.038	0.038
Total	1.231	0.041	0.950	1.336	1.224	1.816	0.621	0.648	0.309	0.353	0.041	0.041

Notes: (a) Includes 0.18 ton per day from industrial land use.

(b) Includes 0.35 ton per day from industrial land use.

N/A = not available

Table I-7. K. I. Sawyer AFB - Emissions Inventory for Carbon Monoxide (tons/day)

Source	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
			2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	2.963	0.000	0.762	0.890	0.788	1.321	0.663	0.776	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.284	0.282	0.261	0.078	0.394	0.012	0.164	0.163	0.000	0.000
Motor Vehicle	2.480	0.024	1.701	2.982	2.742	3.501	1.399	2.232	0.499	0.767	0.024	0.022
Other Operation Sources	0.414	0.038	0.684 ^(a)	0.944 ^(b)	0.414	0.414	0.414	0.414	0.189	0.189	0.038	0.038
Total	5.857	0.062	3.431	5.098	4.205	5.314	2.870	3.434	0.852	1.119	0.062	0.060

Notes: (a) Includes 0.27 ton per day from industrial land use.

(b) Includes 0.53 ton per day from industrial land use.

N/A = not available

Table I-8. K. I. Sawyer AFB - Emissions Inventory for Sulfur Dioxide (tons/day)

Source	Preclosure	Closure	Proposed Action	International Wayport Alternative				Commercial Aviation Alternative				Recreation Alternative				No-Action Alternative			
				2000	2005	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	0.063	0.000	0.007	0.007	0.008	0.018	0.038	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.007	0.007	0.007	0.007	0.002	0.010	0.000	0.000	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Motor Vehicle	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Operation Sources	0.346	0.068	0.376 ^(a)	0.396 ^(b)	0.396 ^(b)	0.346	0.346	0.346	0.346	0.342	0.342	0.342	0.342	0.342	0.342	0.068	0.068	0.068	0.068
Total	0.409	0.068	0.390	0.411	0.411	0.371	0.386	0.358	0.349	0.346	0.346	0.346	0.346	0.346	0.346	0.068	0.068	0.068	0.068

Notes: (a) Includes 0.03 ton per day from industrial land use.

(b) Includes 0.05 ton per day from industrial land use.

N/A = not available

Table I-9. K. I. Sawyer AFB - Emissions Inventory for Particulate Matter (tons/day)

Source	Preclosure	Closure	Proposed Action	International Wayport Alternative				Commercial Aviation Alternative				Recreation Alternative				No-Action Alternative			
				2000	2005	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	0.440	0.000	0.013	0.013	0.015	0.011	0.023	0.011	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.039	0.039	0.039	0.036	0.011	0.054	0.001	0.023	0.023	0.023	0.023	0.000	0.000	0.000	0.000	0.000	0.000
Motor Vehicle	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Operation Sources	0.007	0.000	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Total	0.447	0.000	0.059	0.061	0.061	0.054	0.041	0.072	0.020	0.024	0.024	0.024	0.024	0.000	0.000	0.000	0.000	0.000	0.000

N/A = not available

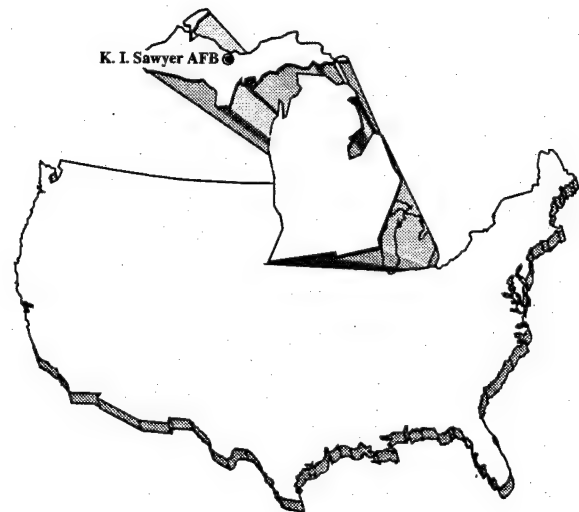
Table I-10. K. I. Sawyer AFB - Emissions Inventory for Volatile Organic Compounds (tons/day)

Source	Preclosure		Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
	1992	1995		2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	2.021	0.000		0.085	0.092	0.055	0.191	0.066	0.073	0.000	0.000	0.000	0.000
Construction	N/A	N/A		0.022	0.021	0.020	0.006	0.030	0.001	0.012	0.012	0.000	0.000
Motor Vehicle	0.231	0.002		0.169	0.295	0.272	0.346	0.139	0.221	0.049	0.076	0.002	0.002
Other Operation Sources	0.166	0.001		0.796 ^(a)	1.436 ^(b)	0.166	0.166	0.186	0.166	0.152	0.152	0.001	0.001
Total	2.418	0.003		1.072	1.844	0.513	0.709	0.421	0.461	0.213	0.240	0.003	0.003

Notes: (a) Includes 0.63 ton per day from industrial land use.

(b) Includes 1.27 tons per day from industrial land use.

N/A = not available



APPENDIX J

APPENDIX J

NOISE

APPENDIX J

NOISE

1.0 DESCRIPTION OF PROPOSED ALTERNATIVES

1.1 PRECLOSURE

Typical noise sources on and around airfields usually include aircraft, surface traffic, and other human activities.

Military aircraft operations are the primary source of noise in the vicinity of K. I. Sawyer Air Force Base (AFB). The air operations and noise contours for preclosure are taken from the Air Installation Compatible Use Zone study (U.S. Air Force, 1993) for K. I. Sawyer AFB. The contours for preclosure operations are shown in Figure 3.4-4 in Section 3.4.4 (Noise) of this Environmental Impact Statement (EIS). In airport analyses, areas exposed to a day-night average sound level (DNL) of 65 decibels (dB) are considered in land use compatibility planning and impact assessment; therefore, these areas were of particular interest.

The surface traffic noise levels in the vicinity of the base were established in terms of DNL by modeling the arterial roadways near the base using current traffic and speed characteristics. Annual average daily traffic (AADT) data, traffic mix, road width, speed, and day/night split were developed in the traffic engineering study presented in Section 3.2.3, Transportation, and were used to estimate preclosure noise levels. The traffic data used in the analysis are presented in Table J-1. The noise levels generated by surface traffic were predicted using the model published by the Federal Highway Administration (FHWA) (1978). The noise levels are estimated as a function of distance from the centerline of the nearest road. Number of residents impacted was determined from aerial photographs dated November 9, 1991 and U. S. Geological Survey (USGS) maps dated photo revised 1975 and provisional 1985.

1.2 CLOSURE BASELINE

At closure, it is assumed that there would be no aircraft activity. The noise levels projected for the closure baseline for surface traffic were calculated using the traffic projections at base closure. The AADTs used for the analysis are presented in Table J-1.

Table J-1. Surface Traffic Operations for Total Traffic Volumes (Preclosure and Closure)

Roadway	Segment	Annual Average Daily Traffic	Speed Assumed (mph)	Rd. Width Assumed (no. of lanes)	Day/Night Split (percent)	Percentage Trucks Medium/Heavy
Preclosure						
CR 462	Main Gate to CR 553	5,580	45	2	89/11	0.5/0.5
CR 460	Gate 2 to CR 545	1,840	55	2	89/11	2.1/0.6
CR 460	CR 545 to U.S. 41	1,400	55	2	89/11	2.1/0.6
CR 480	West of CR 553	3,935	55	2	89/11	2.4/5.8
CR 480	CR 553 to U.S. 41	2,500	55	2	89/11	2.4/5.8
CR 553	Marquette city limits to CR 480	5,800	55	2	89/11	2.8/2.9
CR 553	CR 480 to CR 462	6,040	55	2	89/11	2.8/2.9
CR 553	CR 462 to Southgate Drive	6,570	55	2	89/11	2.8/2.9
CR 553	Southgate Drive to SH 35	3,790	55	2	89/11	2.8/2.9
CR 545	U.S. 41 to CR 460	890	45	2	89/11	2.1/1.6
CR 545	CR 460 to CR 456	210	45	2	89/11	2.1/1.6
CR 456	SH 35 to CR 545	1,750	55	2	89/11	2.1/1.6
CR 456	CR 545 to U.S. 41	515	55	2	89/11	2.1/1.6
U.S. 41	SH 28 to Skandia	5,700	55	2	89/11	3.9/4.2
U.S. 41	Skandia to SH 94	3,800	55	2	89/11	3.9/4.2
U.S. 41	SH 94 to CR 456	2,000	55	2	89/11	3.9/4.2
SH 35	CR 553 to CR 456	2,500	55	2	89/11	2.6/2.3
SH 35	CR 456 to Morbit Lake Access	730	55	2	89/11	2.6/2.3
Closure						
CR 462	Main Gate to CR 553	100	45	2	89/11	0.5/0.5
CR 460	Gate 2 to CR 545	25	55	2	89/11	2.1/0.6
CR 460	CR 545 to U.S. 41	1,365	55	2	89/11	2.1/0.6
CR 480	West of CR 553	3,870	55	2	89/11	2.4/5.8
CR 480	CR 553 to U.S. 41	2,810	55	2	89/11	2.4/5.8
CR 553	Marquette city limits to CR 480	4,980	55	2	89/11	2.8/2.9
CR 553	CR 480 to CR 462	4,695	55	2	89/11	2.8/2.9
CR 553	CR 462 to Southgate Drive	4,370	55	2	89/11	2.8/2.9
CR 553	Southgate Drive to SH 35	3,150	55	2	89/11	2.8/2.9
CR 545	U.S. 41 to CR 460	800	45	2	89/11	2.1/1.6
CR 545	CR 460 to CR 456	100	45	2	89/11	2.1/1.6
CR 456	SH 35 to CR 545	1,830	55	2	89/11	2.1/1.6
CR 456	CR 545 to U.S. 41	440	55	2	89/11	2.1/1.6
U.S. 41	SH 28 to Skandia	6,205	55	2	89/11	3.9/4.2
U.S. 41	Skandia to SH 94	4,070	55	2	89/11	3.9/4.2
U.S. 41	SH 94 to CR 456	2,250	55	2	89/11	3.9/4.2
SH 35	CR 553 to CR 456	1,700	55	2	89/11	2.6/2.3
SH 35	CR 456 to Morbit Lake Access	820	55	2	89/11	2.6/2.3
CR MPH	= County Road miles per hour	SH U.S.#	= State Highway			

K. I. Sawyer AFB Disposal FEIS

1.3 PROPOSED ACTION

The Proposed Action for the reuse of K. I. Sawyer AFB would result in a comprehensive reuse plan centered on a mixed-use civil aviation facility. Primary components of the aviation action include air passenger operations, air cargo, maintenance, and general aviation operations. Non-aviation land uses include industrial, commercial, institutional, residential, public facilities/recreation, and military lands.

The fleet mix and annual aircraft operations for each of the modeled years are contained in Table J-2. The DNL contours for the proposed flight operations and the proposed flight tracks modeled are presented in Section 4.4.4, Noise. The day-night split for all aircraft operations is shown in Table J-3. Stage lengths for aircraft operations are given in Table J-4.

Engine runup operations were assumed to occur at the southeast corner of the apron. The number of runup operations is presented in Table J-5. During typical runup operations, the engines would run for 20 minutes at idle power and 5 minutes at departure power. It was assumed that no noise suppression facilities would be available. The aircraft were assumed to have a heading of 20 degrees.

General aviation operations were divided into four types:

- Single-engine, piston-driven propeller - A composite single-engine propeller (COMSEP) plane was modeled.
- Multi-engine, piston-driven propeller - Beech Baron 58P assumed to be a typical multi-engine propeller plane.
- Turboprop - Beech King Air assumed to be a typical turboprop.
- Turbofan - Gulfstream IV assumed to be a typical turbofan.

The touch and go patterns and the initial departure and final approach flight tracks used in the modeling are shown in Figure J-1. The touch and go flight tracks were based on those in common usage at similar sized airports. Touch and go operations were assumed to consist of 41 percent of all single-engine piston and 16 percent of multi-engine piston general aviation operations and were split 50/50 on two tracks (one for runway 01 and one for runway 19). Daily operations assigned to each flight track and time period for the Proposed Action are provided in Table J-6 for each of the study years. Assignments were made in a similar way for the other alternatives.

Table J-2a. Annual Operations for the Proposed Action (2000)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			11,600	25.1
Beech 1900	2,552	22		
Saab 340	232	2		
ATR-42	8,352	72		
ATR-72	464	4		
Air Cargo			3,000	6.5
757	1,500	50		
MD-11	1,000	33.3		
747-400	500	16.7		
Aircraft Maintenance			600	1.3
Beech 1900	300	50		
ATR-42	300	50		
ATR-72	0	0		
General Aviation			30,700	66.5
Single Engine	23,700	77.2		
Multi-engine	5,000	16.3		
Turboprop	1,000	3.3		
Turbojet	1,000	3.3		
Military			288	0.6
CF-5	96	33.3		
CT-33	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			46,188	

Table J-2b. Annual Operations for the Proposed Action (2005)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			13,000	24.9
Beech 1900	2,600	20		
Saab 340	650	5		
ATR-42	9,100	70		
ATR-72	650	5		
Air Cargo			3,000	5.8
757	1,000	33.3		
MD-11	1,000	33.3		
747-400	1,000	33.3		
Aircraft Maintenance			750	1.4
Beech 1900	300	40		
ATR-42	300	40		
ATR-72	150	20		
General Aviation			35,100	67.3
Single Engine	26,500	75.5		
Multi-engine	6,300	17.9		
Turboprop	1,300	3.7		
Turbojet	1,000	2.8		
Military			288	0.6
CF-5	96	33.3		
CT-33	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			52,138	

Table J-2c. Annual Operations for the Proposed Action (2015)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			15,500	23.8
Beech 1900	2,325	15		
Saab 340	1,085	7		
ATR-42	10,540	68		
ATR-72	1,550	10		
Air Cargo			3,000	4.6
757	500	16.7		
MD-11	1,000	33.3		
747-400	1,500	50		
Aircraft Maintenance			900	1.4
Beech 1900	150	16.7		
ATR-42	450	50		
ATR-72	300	33.3		
General Aviation			45,400	69.8
Single Engine	34,000	74.9		
Multi-engine	8,500	18.7		
Turboprop	1,700	3.7		
Turbojet	1,200	2.6		
Military			288	0.4
CF-5	96	33.3		
CT-33	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			65,088	

Table J-3. Day/Night Split of Aircraft Operations for Proposed Action and Alternatives

Aircraft Type	Percent Daytime	Percent Nighttime
Proposed Action		
Air Cargo	50	50
Aircraft Maintenance	100	0
Air Carrier	97	3
General Aviation	93	7
Military	100	0
International Wayport Alternative		
Air Cargo	70	30
Air Carrier (International)	100	0
Maintenance	100	0
Air Carrier (Regional)	91	9
General Aviation	93	7
Military	100	0
Commercial Aviation Alternative		
Air Carrier	97	3
General Aviation	90	10

Note: Percentages are approximate for each category. Different aircraft within each category may have different day-night splits. For actual number of operations of each aircraft for each time period, refer to Table J-6. Daytime operations are assumed to occur between the hours of 7:00 a.m. and 7:00 p.m. Evening hours are assumed to occur between the hours of 7:00 p.m and 7:00 a.m.

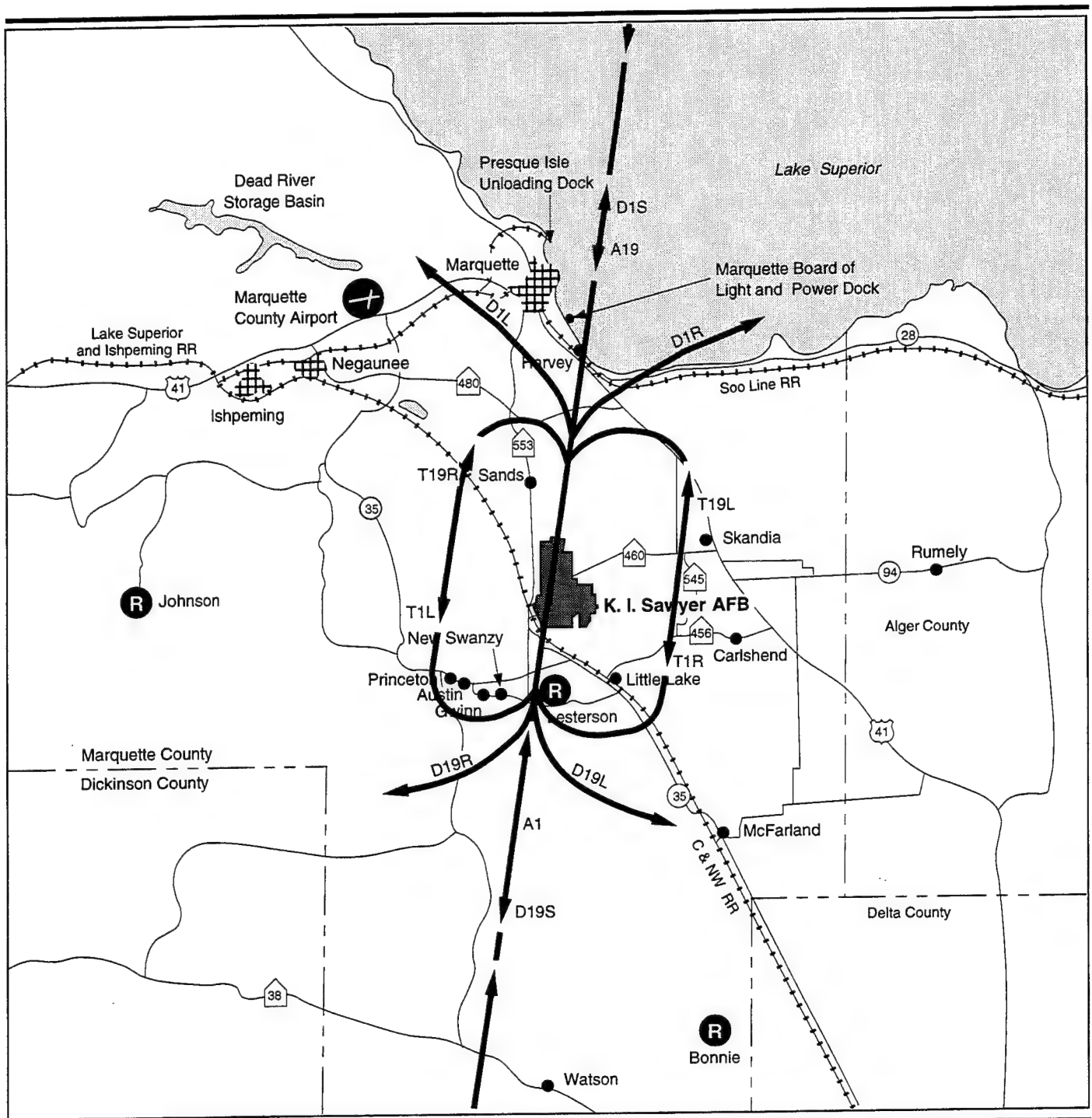
**Table J-4. Stage Lengths Assumed for Aircraft Operations for the
Proposed Action and Alternatives**

Group	2000	2005	2015
Proposed Action			
Air Carrier	1	1	1
Air Cargo			
747-400		4	4
MD-11		4	4
757		2	2
Aircraft Maintenance	1	1	1
General Aviation	1	1	1
Military	2	2	2
International Wayport Alternative			
Air Cargo			
747-400		4	4
MD-11		4	4
757		2	2
Air Carrier (International)			
747-400		4	4
MD-11		4	4
757		2	2
Maintenance			
747-400		4	4
MD-11		4	4
757		2	2
Air Carrier (Regional)			
B-737-400		2	2
S-2000		1	1
Metro4		1	1
General Aviation	1	1	1
Military	2	2	2
Commercial Aviation Alternative			
Air Carrier	1	1	1
General Aviation	1	1	1









Note: Stage length may affect operational parameters such as takeoff or landing profiles, engine thrust settings, and aircraft speed of some aircraft; these parameters may in turn affect aircraft noise exposure. Stage lengths correspond to the distance flown in increments of 500 miles (e.g., stage length 1 corresponds to flights between 1 and 500 miles; 2 corresponds to flights between 500 and 1,000 miles, etc.). The maximum stage length used in modeling is 7 (>4,500 miles).

Table J-5. Number of Daily Runup Operations for the Proposed Action and Alternatives

Alternative	2000	2005	2015
Proposed Action			
Beech 1900	0.07	0.07	0.03
ATR-42	0.07	0.07	0.1
ATR-72	0	0.03	0.07
International Wayport Alternative			
747-400	0.08	0.17	0.26
MD-11	0.08	0.17	0.26
757	0.17	0.34	0.51
Commercial Aviation Alternative	0	0	0



EXPLANATION

-  Flight Paths
-  U.S. Highway
-  State Highway
-  County Road
-  Restricted/Private Use Airport
-  Public Use Airport
-  County Line
-  Chicago and Northwestern

Civilian Flight Tracks- Proposed Action and Commercial Aviation Alternative



Figure J-1

Table J-6a. Assignment of Operations for the Proposed Action (2000)
Page 1 of 2

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
ATR-42	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
ATR-72	-	-		-	-		-	-		-	-		-	-		-	-	
757	0.16	0.32		0.16	0.32		0.16	0.32		0.07	0.14		0.07	0.14		0.07	0.14	
MD-11	0.16	0.16		0.16	0.16		0.16	0.16		0.07	0.07		0.07	0.07		0.07	0.07	
747-400	0.16	-		0.16	-		0.16	-		0.07	-		0.07	-		0.07	-	
Beech1900	0.82	-		0.82	-		0.82	-		0.35	-		0.35	-		0.35	-	
Saab340	0.08	-		0.08	-		0.08	-		0.03	-		0.03	-		0.03	-	
ATR-42	2.57	0.10		2.57	0.10		2.57	0.10		1.10	0.04		1.10	0.04		1.10	0.04	
ATR-72	0.15	-		0.15	-		0.15	-		0.06	-		0.06	-		0.06	-	
COMSEP	4.32	0.23		4.32	0.23		4.32	0.23		1.85	0.10		1.85	0.10		1.85	0.10	
BEC58P	1.22	0.14		1.22	0.14		1.22	0.14		0.52	0.06		0.52	0.06		0.52	0.06	
CNA442	0.27	0.05		0.27	0.05		0.27	0.05		0.12	0.02		0.12	0.02		0.12	0.02	
G-IV	0.27	0.05		0.27	0.05		0.27	0.05		0.12	0.02		0.12	0.02		0.12	0.02	
CF-5	0.03	-		0.03	-		0.03	-		0.01	-		0.01	-		0.01	-	
CT-33	0.00	-		0.00	-		0.00	-		0.00	-		0.00	-		0.00	-	
CF/FA-18	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
CT-114	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
F-16	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
UH-1	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.05	-		0.02	-		-	-		-	-		-	-		-	-	
ATR-42	0.05	-		0.02	-		-	-		-	-		-	-		-	-	
ATR-72	-	-		-	-		-	-		-	-		-	-		-	-	
757	0.48	0.96		0.20	0.41		-	-		-	-		-	-		-	0.31	
MD-11	0.48	0.48		0.20	0.20		-	-		-	-		-	-		-	-	
747-400	0.48	-		0.20	-		-	-		-	-		-	-		-	-	
Beech1900	2.45	-		1.05	-		-	-		-	-		-	-		-	-	
Saab340	0.23	-		0.10	-		-	-		-	-		-	-		-	-	
ATR-42	7.71	0.30		3.30	0.13		5.78	-		-	-		-	-		-	-	

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Table J-6a. Assignment of Operations for the Proposed Action (2000)
Page 2 of 2

Aircraft	A1			A19			T1L		T1R		T19L		T19R	
	Day	Night		Day	Night		Day	Night	Day	Night	Day	Night	Day	Night
ATR-72	0.44	-		0.19	-		0.33	-	0.11	-	0.05	-	0.14	-
G-IV	0.82	0.14		0.35	0.06		-	-	-	-	-	-	-	-
CF-5	0.09	-		0.04	-		-	-	-	-	-	-	-	-
CT-33	0.01	-		0.01	-		-	-	-	-	-	-	-	-
CF/FA-18	0.02	-		0.01	-		-	-	-	-	-	-	-	-
CT-114	0.07	-		0.03	-		-	-	-	-	-	-	-	-
F-16	0.05	-		0.02	-		-	-	-	-	-	-	-	-
UH-1	0.03	-		0.01	-		-	-	-	-	-	-	-	-
Beech1900	-	-		-	-		0.18	-	0.06	-	0.03	-	0.08	-
ATR-42	-	-		-	-		0.18	-	0.06	-	0.03	-	0.08	-
ATR-72	-	-		-	-		-	-	-	-	-	-	-	-
COMSEP	-	-		-	-		-	-	-	-	-	-	-	-
BEC58P	-	-		-	-		6.82	-	2.27	-	0.97	-	2.92	-
	-	-		-	-		0.54	-	0.18	-	0.08	-	0.23	-

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Table J-6b. Assignment of Operations for the Proposed Action (2005)
Page 1 of 2

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
ATR-42	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
ATR-72	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
757	0.16	0.16		0.16	0.16		0.16	0.16		0.07	0.07		0.07	0.07		0.07	0.07	
MD-11	0.16	0.16		0.16	0.16		0.16	0.16		0.07	0.07		0.07	0.07		0.07	0.07	
747-400	0.32	-		0.32	-		0.32	-		0.14	-		0.14	-		0.14	-	
Beech1900	0.83	-		0.83	-		0.83	-		0.36	-		0.36	-		0.36	-	
Saab340	0.21	-		0.21	-		0.21	-		0.09	-		0.09	-		0.09	-	
ATR-42	2.71	0.20		2.71	0.20		2.71	0.20		1.16	0.09		1.16	0.09		1.16	0.09	
ATR-72	0.21	-		0.21	-		0.21	-		0.09	-		0.09	-		0.09	-	
COMSEP	4.83	0.25		4.83	0.25		4.83	0.25		2.07	0.11		2.07	0.11		2.07	0.11	
BEC58P	1.54	0.17		1.54	0.17		1.54	0.17		0.66	0.07		0.66	0.07		0.66	0.07	
CNA442	0.36	0.06		0.36	0.06		0.36	0.06		0.15	0.03		0.15	0.03		0.15	0.03	
G-IV	0.27	0.05		0.27	0.05		0.27	0.05		0.12	0.02		0.12	0.02		0.12	0.02	
CF-5	0.03	-		0.03	-		0.03	-		0.01	-		0.01	-		0.01	-	
CT-33	0.00	-		0.00	-		0.00	-		0.00	-		0.00	-		0.00	-	
CF/FA-18	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
CT-114	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
F-16	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
UH-1	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.05	-		0.02	-		-	-		-	-		-	-		-	-	
ATR-42	0.05	-		0.02	-		-	-		-	-		-	-		-	-	
ATR-72	0.02	-		0.01	-		-	-		-	-		-	-		-	-	
757	0.48	0.48		0.21	0.21		0.36	-		-	-		-	-		-	0.15	
MD-11	0.48	0.48		0.21	0.21		-	-		-	-		-	-		-	-	

Table J-6b. Assignment of Operations for the Proposed Action (2005)
Page 2 of 2

Aircraft	A1		A19		T1L		T1R		T19L		T19R	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.96	-	0.41	-	-	-	-	-	-	-	-	-
Beech1900	2.49	-	1.07	-	-	-	-	-	-	-	-	-
Saab340	0.63	-	0.27	-	-	-	-	-	-	-	-	-
ATR-42	8.13	0.60	3.48	0.26	6.10	-	-	-	-	-	-	-
ATR-72	0.63	-	0.27	-	0.47	-	0.16	-	0.07	-	0.20	-
COMSEP	14.48	0.76	6.20	0.33	-	-	-	-	-	-	-	-
BEC58P	4.62	0.52	1.98	0.22	-	-	-	-	-	-	-	-
CNA442	1.07	0.19	0.46	0.08	-	-	-	-	-	-	-	-
G-IV	0.82	0.14	0.35	0.06	-	-	-	-	-	-	-	-
CF-5	0.09	-	0.04	-	-	-	-	-	-	-	-	-
CT-33	0.01	-	0.01	-	-	-	-	-	-	-	-	-
CF/FA-18	0.02	-	0.01	-	-	-	-	-	-	-	-	-
CT-114	0.07	-	0.03	-	-	-	-	-	-	-	-	-
F-16	0.05	-	0.02	-	-	-	-	-	-	-	-	-
UH-1	0.03	-	0.01	-	-	-	-	-	-	-	-	-
Beech1900	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
ATR-42	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
ATR-72	-	-	-	-	0.09	-	0.03	-	0.01	-	0.04	-
COMSEP	-	-	-	-	7.62	-	2.54	-	1.09	-	3.27	-
BEC58P	-	-	-	-	0.68	-	0.23	-	0.10	-	0.29	-

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Table J-6c. Assignment of Operations for the Proposed Action (2015)
Page 1 of 2

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
ATR-42	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
ATR-72	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
757	0.16	-		0.16	-		0.16	-		0.07	-		0.07	-		0.07	-	
MD-11	0.16	0.16		0.16	0.16		0.16	0.16		0.07	0.07		0.07	0.07		0.07	0.07	
747-400	0.32	0.16		0.32	0.16		0.32	0.16		0.14	0.07		0.14	0.07		0.14	0.07	
Beech1900	0.74	-		0.74	-		0.74	-		0.32	-		0.32	-		0.32	-	
Saab340	0.35	-		0.35	-		0.35	-		0.15	-		0.15	-		0.15	-	
ATR-42	3.17	0.20		3.17	0.20		3.17	0.20		1.36	0.09		1.36	0.09		1.36	0.09	
ATR-72	0.49	-		0.49	-		0.49	-		0.21	-		0.21	-		0.21	-	
COMSEP	6.20	0.33		6.20	0.33		6.20	0.33		2.66	0.14		2.66	0.14		2.66	0.14	
BEC58P	2.07	0.23		2.07	0.23		2.07	0.23		0.89	0.10		0.89	0.10		0.89	0.10	
CNA442	0.46	0.08		0.46	0.08		0.46	0.08		0.20	0.03		0.20	0.03		0.20	0.03	
G-IV	0.33	0.06		0.33	0.06		0.33	0.06		0.14	0.02		0.14	0.02		0.14	0.02	
CF-5	0.03	-		0.03	-		0.03	-		0.01	-		0.01	-		0.01	-	
CT-33	0.00	-		0.00	-		0.00	-		0.00	-		0.00	-		0.00	-	
CF/FA-18	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
CT-114	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
F-16	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
UH-1	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.02	-		0.01	-		-	-		-	-		-	-		-	-	
ATR-42	0.07	-		0.03	-		-	-		-	-		-	-		-	-	
ATR-72	0.05	-		0.02	-		-	-		-	-		-	-		-	-	
757	0.48	-		0.21	-		0.36	-		-	-		-	-		-	-	
MD-11	0.48	0.48		0.21	0.21		-	-		-	-		-	-		-	-	

Table J-6c. Assignment of Operations for the Proposed Action (2015)
Page 2 of 2

Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
747-400	0.96	0.48		0.41	0.21		-	-		-	-		-	-		-	-	
Beech1900	2.23	-		0.95	-		-	-		-	-		-	-		-	-	
Saab340	1.04	-		0.45	-		-	-		-	-		-	-		-	-	
ATR-42	9.52	0.60		4.08	0.26		7.14	-		-	-		-	-		-	-	
ATR-72	1.48	-		0.64	-		1.11	-		0.37	-		0.16	-		0.48	-	
COMSEP	18.59	0.98		7.97	0.42		-	-		-	-		-	-		-	-	
BEC58P	6.22	0.69		2.67	0.30		-	-		-	-		-	-		-	-	
CNA442	1.39	0.24		0.59	0.10		-	-		-	-		-	-		-	-	
G-IV	0.98	0.17		0.42	0.07		-	-		-	-		-	-		-	-	
CF-5	0.09	-		0.04	-		-	-		-	-		-	-		-	-	
CT-33	0.01	-		0.01	-		-	-		-	-		-	-		-	-	
CF/FA-18	0.02	-		0.01	-		-	-		-	-		-	-		-	-	
CT-114	0.07	-		0.03	-		-	-		-	-		-	-		-	-	
F-16	0.05	-		0.02	-		-	-		-	-		-	-		-	-	
UH-1	0.03	-		0.01	-		-	-		-	-		-	-		-	-	
Beech1900	-	-		-	-		0.09	-		0.03	-		0.01	-		0.04	-	
ATR-42	-	-		-	-		0.27	-		0.09	-		0.04	-		0.12	-	
ATR-72	-	-		-	-		0.18	-		0.06	-		0.03	-		0.08	-	
COMSEP	-	-		-	-		9.78	-		3.26	-		1.40	-		4.19	-	
BEC58P	-	-		-	-		0.92	-		0.31	-		0.13	-		0.39	-	

K. I. Sawyer AFB Disposal FEIS

A standard 3 degree glide slope and the takeoff profiles provided by the Federal Aviation Administration's (FAA) Integrated Noise Model (INM) Database 4.11 (Federal Aviation Administration, 1993) were assumed for all aircraft.

Surface traffic data used in the modeling were developed from the project traffic study presented in Section 4.2.3, Transportation, and are shown in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from aerial photographs dated November 9, 1991 and USGS maps dated photorevised 1975 and provisional 1985.

1.4 INTERNATIONAL WAYPORT ALTERNATIVE

Under the International Wayport Alternative, as in the Proposed Action, the base airfield would be converted to civilian use. The primary components of the aviation action include air passenger, maintenance, air cargo, and general aviation operations.

The airport layout would change under this alternative. A crosswind runway would be constructed after the year 2005.

The fleet mix and annual operations for each of the modeled years are contained in Table J-8. The DNL contours for the proposed flight operations are presented in Section 4.4.4, Noise. The proposed flight tracks modeled are slightly different from those for the Proposed Action due to the runway configuration change described above. The International Wayport flight tracks are shown in Figure J-2. The day/night split for all aircraft operations are given in Table J-3. Stage lengths for air operations are given in Table J-4.

Engine runup operations were assumed to occur at the same location as in the Proposed Action as described in Section 4.4.4, Noise. The number of runup operations is given in Table J-5. During typical runup operations, the engines would run for 20 minutes at idle power and 5 minutes at departure power. It was assumed that no noise suppression facilities would be available. The aircraft were assumed to have a heading of 20 degrees.

General aviation operations would be divided into the same general categories as in the Proposed Action. It was assumed that 41 percent of the single-engine piston and 16 percent of the multi-engine piston general aviation operations would be touch-and-go (or closed loop) activities.

A standard 3 degree glide slope and the takeoff profiles provided by the FAA's INM Database 4.11 were assumed for all aircraft. Daily operations assigned to each flight track and the time period for the International Wayport Alternative are provided in Table J-9.

Table J-7a. Surface Traffic Operations for Total Volumes (Project and Non-Project)

Alternative	Roadway	Segment	Annual Average Daily Traffic (AADT)		
			2000	2005	2015
Proposed Action	CR 462	Main Gate to CR 553	4,300	8,150	15,500
	CR 460	Gate 2 to CR 545	2,600	4,750	9,450
	CR 460	CR 545 to U.S. 41	2,600	3,850	6,900
	CR 480	West of CR 553	5,400	7,200	11,250
	CR 480	CR 553 to U.S. 41	3,600	4,500	6,750
	CR 553	Marquette city limits to CR 480	8,100	10,800	18,000
	CR 553	CR 480 to CR 462	9,450	14,400	24,300
	CR 553	CR 462 to Southgate Drive	9,450	14,400	24,300
	CR 553	Southgate Drive to SH 35	5,400	7,650	11,700
	CR 545	U.S. 41 to CR 460	1,800	2,700	4,950
	CR 545	CR 460 to CR 456	900	1,350	2,700
	CR 456	SH 35 to CR 545	3,150	4,050	6,750
	CR 456	CR 545 to U.S. 41	1,350	2,250	3,600
	U.S. 41	SH 28 to Skandia	8,050	10,050	15,250
	U.S. 41	Skandia to SH 94	5,200	6,850	10,450
	U.S. 41	SH 94 to CR 456	2,800	3,600	5,200
	SH 35	CR 553 to CR 456	4,050	6,300	10,600
	SH 35	CR 456 to Morbit Lake Access	900	1,350	2,250
International Wayport Alternative	CR 462	Main Gate to CR 553	8,200	11,600	17,650
	CR 460	Gate 2 to CR 545	3,450	4,300	6,900
	CR 460	CR 545 to U.S. 41	3,000	3,900	5,600
	CR 480	West of CR 553	5,850	7,200	10,350
	CR 480	CR 553 to U.S. 41	3,600	4,500	6,750
	CR 553	Marquette city limits to CR 480	8,550	10,800	16,200
	CR 553	CR 480 to CR 462	10,350	13,950	21,150
	CR 553	CR 462 to Southgate Drive	10,350	13,500	20,700
	CR 553	Southgate Drive to SH 35	5,850	7,200	10,800
	CR 545	U.S. 41 to CR 460	2,250	2,700	4,050
	CR 545	CR 460 to CR 456	900	1,350	2,250
	CR 456	SH 35 to CR 545	3,150	4,050	5,850
	CR 456	CR 545 to U.S. 41	1,800	1,800	3,150
	U.S. 41	SH 28 to Skandia	8,000	10,050	14,850
	U.S. 41	Skandia to SH 94	5,600	6,800	10,050
	U.S. 41	SH 94 to CR 456	2,800	3,600	5,200
	SH 35	CR 553 to CR 456	4,500	6,300	9,000
	SH 35	CR 456 to Morbit Lake Access	900	1,350	2,250

CR = County Road
SH = State Highway
U.S.# = U.S. Highway

Table J-7b. Surface Traffic Operations for Total Volumes (Project and Non-Project)

Alternative	Roadway	Segment	Annual Average Daily Traffic (AADT)		
			2000	2005	2015
Commercial	CR 462	Main Gate to CR 553	5,150	8,600	14,200
Aviation	CR 460	Gate 2 to CR 545	1,700	3,000	4,750
Alternative	CR 460	CR 545 to U.S. 41	2,150	3,000	4,750
	CR 480	West of CR 553	5,400	6,750	9,900
	CR 480	CR 553 to U.S. 41	3,600	4,500	6,300
	CR 553	Marquette city limits to CR 480	7,200	9,500	14,400
	CR 553	CR 480 to CR 462	8,100	11,250	17,550
	CR 553	CR 462 to Southgate Drive	8,100	10,800	17,100
	CR 553	Southgate Drive to SH 35	5,000	6,300	9,450
	CR 545	U.S. 41 to CR 460	1,350	2,250	3,150
	CR 545	CR 460 to CR 456	450	900	1,350
	CR 456	SH 35 to CR 545	2,700	3,800	5,400
	CR 456	CR 545 to U.S. 41	900	1,350	2,250
	U.S. 41	SH 28 to Skandia	8,050	9,650	14,450
	U.S. 41	Skandia to SH 94	5,200	6,400	9,650
	U.S. 41	SH 94 to CR 456	2,800	3,600	5,200
	SH 35	CR 553 to CR 456	3,150	4,500	7,200
	SH 35	CR 456 to Morbit Lake Access	900	1,350	1,800
Recreation	CR 462	Main Gate to CR 553	1,570	2,220	3,530
Alternative	CR 460	Gate 2 to CR 545	470	570	1,080
	CR 460	CR 545 to U.S. 41	1,880	2,310	3,450
	CR 480	West of CR 553	4,840	5,920	8,790
	CR 480	CR 553 to U.S. 41	3,430	4,180	6,200
	CR 553	Marquette city limits to CR 480	6,370	7,830	11,650
	CR 553	CR 480 to CR 462	6,420	7,970	11,920
	CR 553	CR 462 to Southgate Drive	6,050	7,530	11,280
	CR 553	Southgate Drive to SH 35	4,110	5,050	7,530
	CR 545	U.S. 41 to CR 460	1,140	1,420	2,140
	CR 545	CR 460 to CR 456	250	330	510
	CR 456	SH 35 to CR 545	2,330	2,860	4,260
	CR 456	CR 545 to U.S. 41	680	860	1,300
	U.S. 41	SH 28 to Skandia	7,610	9,280	13,750
	U.S. 41	Skandia to SH 94	4,970	6,070	9,000
	U.S. 41	SH 94 to CR 456	2,750	3,350	4,970
	SH 35	CR 553 to CR 456	2,430	3,040	4,660
	SH 35	CR 456 to Morbit Lake Access	910	1,230	1,820

CR = County Road
SH = State Highway
U.S.# = U.S. Highway

Table J-7c. Surface Traffic Operations for Total Volumes (Project and Non-Project)

Alternative	Roadway	Segment	Annual Average Daily Traffic (AADT)		
			2000	2005	2015
No-Action	CR 462	Main Gate to CR 553	128	152	224
Alternative	CR 460	Gate 2 to CR 545	32	38	56
	CR 460	CR 545 to U.S. 41	1,670	2,040	3,010
	CR 480	West of CR 553	4,700	5,720	8,470
	CR 480	CR 553 to U.S. 41	3,390	4,130	6,110
	CR 553	Marquette city limits to CR 480	6,020	7,320	10,640
	CR 553	CR 480 to CR 462	5,690	6,920	10,250
	CR 553	CR 462 to Southgate Drive	5,310	6,460	9,560
	CR 553	Southgate Drive to SH 35	3,830	4,680	6,900
	CR 545	U.S. 41 to CR 460	980	1,200	1,770
	CR 545	CR 460 to CR 456	110	130	200
	CR 456	SH 35 to CR 545	2,190	2,660	3,940
	CR 456	CR 545 to U.S. 41	550	670	990
	U.S. 41	SH 28 to Skandia	7,520	9,150	13,540
	U.S. 41	Skandia to SH 94	4,880	5,940	8,790
	U.S. 41	SH 94 to CR 456	2,730	3,330	4,930
	SH 35	CR 553 to CR 456	2,080	2,530	3,740
	SH 35	CR 456 to Morbit Lake Access	890	1,200	1,770

CR = County Road
SH = State Highway
U.S.# = U.S. Highway

Table J-8a. Annual Operations for the International Wayport Alternative (2000)

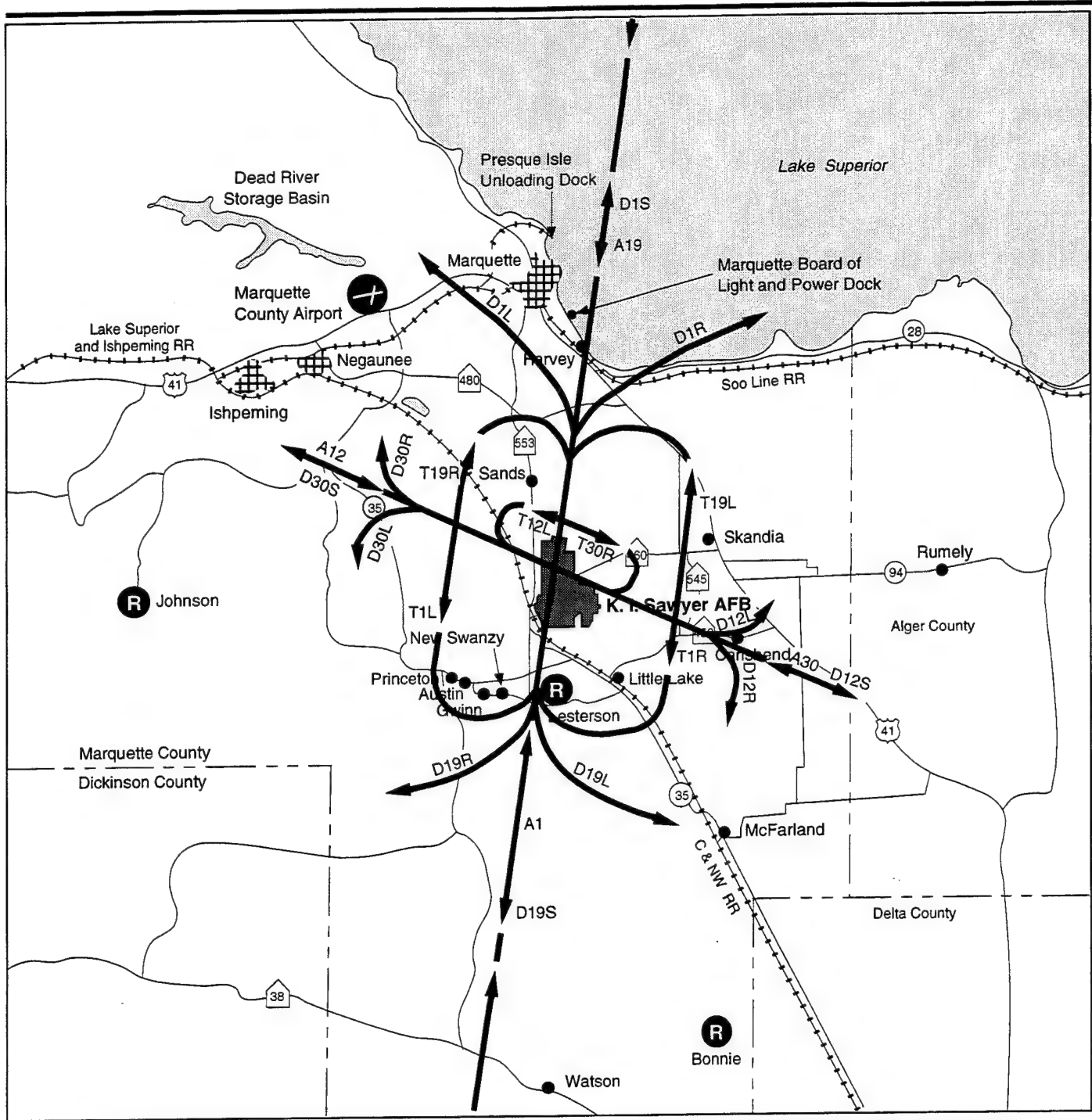
Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Cargo			3,000	6.7
747-400	600	20		
MD-11	1,200	40		
757	1,200	40		
Air Carrier (International)			6,500	14.4
747-400	2,000	30.8		
MD-11	500	7.7		
757	4,000	61.5		
Maintenance			1,000	2.2
747-400	250	25		
MD-11	250	25		
757	500	50		
Air Carrier (Regional)			3,512	7.8
737-400	2,000	56.9		
S-2000	1,512	43.1		
Metro3, 4	0	0		
General Aviation			30,700	68.2
Single Engine	23,700	77.2		
Multi-engine	5,000	16.3		
Turboprop	1,000	3.3		
Turbojet	1,000	3.3		
Military			288	0.6
CF-5	96	33.3		
CT-30	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			45,000	

Table J-8b. Annual Operations for the International Wayport Alternative (2005)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Cargo			9,500	13.1
747-400	1,900	20		
MD-11	3,800	40		
757	3,800	40		
Air Carrier (International)			10,612	14.6
747-400	3,130	29.5		
MD-11	1,222	11.5		
757	6,260	59		
Maintenance			2,000	2.8
747-400	500	25		
MD-11	500	25		
757	1,000	50		
Air Carrier (Regional)			15,000	20.7
737-400	3,000	20		
S-2000	6,000	40		
Metro3, 4	6,000	40		
General Aviation			35,100	48.4
Single Engine	26,500	75.5		
Multi-engine	6,300	17.9		
Turboprop	1,300	3.7		
Turbojet	1,000	2.8		
Military			288	0.4
CF-5	96	33.3		
CT-30	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			72,500	

Table J-8c. Annual Operations for the International Wayport Alternative (2015)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Cargo			13,000	13
747-400	2,600	20		
MD-11	5,200	40		
757	5,200	40		
Air Carrier (International)			16,000	16
747-400	4,800	30		
MD-11	1,600	10		
757	9,600	60		
Maintenance			3,000	3
747-400	750	25		
MD-11	750	25		
757	1,500	50		
Air Carrier (Regional)			22,312	22.3
737-400	5,000	22.4		
S-2000	8,656	38.8		
Metro3, 4	8,656	38.8		
General Aviation			45,400	45.4
Single Engine	34,000	74.9		
Multi-engine	8,500	18.7		
Turboprop	1,700	3.7		
Turbojet	1,200	2.6		
Military			288	0.3
CF-5	96	33.3		
CT-30	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			100,000	



EXPLANATION

- Flight Paths
- U.S. Highway
- State Highway
- County Road
- Restricted/Private Use Airport
- Public Use Airport
- County Line
- C & NW Chicago and Northwestern

Civilian Flight Tracks- International Wayport Alternative



Figure J-2

Table J-9a. Assignment of Operations for the International Wayport Alternative (2000)
Page 1 of 2

Aircraft	D1L		D1S		D1R		D19L		D19S		D19R	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
MD-11	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
757	0.04	-	0.04	-	0.04	-	0.02	-	0.02	-	0.02	-
747-400	0.19	-	0.19	-	0.19	-	0.08	-	0.08	-	0.08	-
MD-11	0.29	0.10	0.29	0.10	0.29	0.10	0.12	0.04	0.12	0.04	0.12	0.04
757	0.19	0.19	0.19	0.19	0.19	0.19	0.08	0.08	0.08	0.08	0.08	0.08
747-400	0.64	-	0.64	-	0.64	-	0.27	-	0.27	-	0.27	-
MD-11	0.16	-	0.16	-	0.16	-	0.07	-	0.07	-	0.07	-
757	1.28	-	1.28	-	1.28	-	0.55	-	0.55	-	0.55	-
737-400	0.61	0.03	0.61	0.03	0.61	0.03	0.26	0.01	0.26	0.01	0.26	0.01
Saab2000	0.41	0.07	0.41	0.07	0.41	0.07	0.18	0.03	0.18	0.03	0.18	0.03
MetroIV	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	5.40	0.38	5.40	0.38	5.40	0.38	2.31	0.16	2.31	0.16	2.31	0.16
BEC58P	1.45	0.08	1.45	0.08	1.45	0.08	0.62	0.03	0.62	0.03	0.62	0.03
CNA442	0.29	0.03	0.29	0.03	0.29	0.03	0.12	0.01	0.12	0.01	0.12	0.01
G-IV	0.29	0.03	0.29	0.03	0.29	0.03	0.12	0.01	0.12	0.01	0.12	0.01
CF-5	0.03	-	0.03	-	0.03	-	0.01	-	0.01	-	0.01	-
CT-33	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
CF/FA-18	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
CT-114	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
F-16	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
UH-1	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
Aircraft	T1L		T1R		T19L		T19R		A1		A19	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	-	-	-	-	-	-	-	-	0.06	-	0.03	-
MD-11	-	-	-	-	-	-	-	-	0.06	-	0.03	-
757	-	-	-	-	-	-	-	-	0.12	-	0.05	-
747-400	-	-	-	-	-	-	-	-	0.58	-	0.25	-
MD-11	-	-	-	-	-	-	-	-	0.86	0.29	0.37	0.12

Table J-9a. Assignment of Operations for the International Wayport Alternative (2000)
Page 2 of 2

Aircraft	T1L		T1R		T19L		T19R		A1		A19	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
757	-	-	-	-	-	-	-	-	0.58	0.57	0.25	0.25
747-400	-	-	-	-	-	-	-	-	1.92	-	0.82	-
MD-11	-	-	-	-	-	-	-	-	0.48	-	0.21	-
757	-	-	-	-	-	-	-	-	3.83	-	1.64	-
737-400	-	-	-	-	-	-	-	-	1.82	0.10	0.78	0.04
Saab2000	-	-	-	-	-	-	-	-	1.24	0.21	0.53	0.09
MetrolIV	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	-	-	-	-	16.19	1.14	6.94	0.49
BEC58P	-	-	-	-	-	-	-	-	4.34	0.24	1.86	0.10
CNA442	-	-	-	-	-	-	-	-	0.87	0.10	0.37	0.04
G-IV	-	-	-	-	-	-	-	-	0.87	0.10	0.37	0.04
CF-5	-	-	-	-	-	-	-	-	0.09	-	0.04	-
CT-33	-	-	-	-	-	-	-	-	0.01	-	0.01	-
CF/FA-18	-	-	-	-	-	-	-	-	0.02	-	0.01	-
CT-114	-	-	-	-	-	-	-	-	0.07	-	0.03	-
F-16	-	-	-	-	-	-	-	-	0.05	-	0.02	-
UH-1	-	-	-	-	-	-	-	-	0.03	-	0.01	-
747-400	0.13	-	0.04	-	0.02	-	0.06	-	-	-	-	-
MD-11	0.13	-	0.04	-	0.02	-	0.06	-	-	-	-	-
757	0.27	-	0.09	-	0.04	-	0.12	-	-	-	-	-
COMSEP	4.05	-	1.35	-	0.58	-	1.74	-	-	-	-	-
BEC58P	0.17	-	0.06	-	0.02	-	0.07	-	-	-	-	-

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Table J-9b. Assignment of Operations for the International Wayport Alternative (2005)
Page 1 of 2

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
747-400	0.04	-		0.04	-		0.04	-		0.02	-		0.02	-		0.02	-	
MD-11	0.04	-		0.04	-		0.04	-		0.02	-		0.02	-		0.02	-	
757	0.08	-		0.08	-		0.08	-		0.03	-		0.03	-		0.03	-	
747-400	0.55	0.06		0.55	0.06		0.55	0.06		0.23	0.02		0.23	0.01		0.23	0.00	
MD-11	0.91	0.30		0.91	0.30		0.91	0.30		0.39	0.13		0.39	0.13		0.39	0.13	
757	0.61	0.61		0.61	0.61		0.61	0.61		0.26	0.26		0.26	0.26		0.26	0.26	
747-400	1.00	-		1.00	-		1.00	-		0.43	-		0.43	-		0.43	-	
MD-11	0.39	-		0.39	-		0.39	-		0.17	-		0.17	-		0.17	-	
757	2.00	-		2.00	-		2.00	-		0.86	-		0.86	-		0.86	-	
737-400	0.91	0.05		0.91	0.05		0.91	0.05		0.39	0.02		0.39	0.02		0.39	0.02	
Saab2000	1.65	0.27		1.65	0.27		1.65	0.27		0.71	0.12		0.71	0.12		0.71	0.12	
MetroIV	1.65	0.27		1.65	0.27		1.65	0.27		0.71	0.12		0.71	0.12		0.71	0.12	
COMSEP	6.04	0.42		6.04	0.42		6.04	0.42		2.59	0.18		2.59	0.18		2.59	0.18	
BEC58P	1.81	0.10		1.81	0.10		1.81	0.10		0.78	0.04		0.78	0.04		0.78	0.04	
CNA442	0.37	0.04		0.37	0.04		0.37	0.04		0.16	0.02		0.16	0.02		0.16	0.02	
G-IV	0.29	0.03		0.29	0.03		0.29	0.03		0.12	0.01		0.12	0.01		0.12	0.01	
CF-5	0.03	-		0.03	-		0.03	-		0.01	-		0.01	-		0.01	-	
CT-33	0.00	-		0.00	-		0.00	-		0.00	-		0.00	-		0.00	-	
CF/FA-18	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
CT-114	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
F-16	0.02	-		0.02	-		0.02	-		0.01	-		0.01	-		0.01	-	
UH-1	0.01	-		0.01	-		0.01	-		0.00	-		0.00	-		0.00	-	
Aircraft	T1L			T1R			T19L			T19R			A1			A19		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
747-400	-	-		-	-		-	-		-	-		0.12	-		0.05	-	
MD-11	-	-		-	-		-	-		-	-		0.12	-		0.05	-	
757	-	-		-	-		-	-		-	-		0.24	-		0.10	-	
747-400	-	-		-	-		-	-		-	-		1.64	-		0.70	-	
MD-11	-	-		-	-		-	-		-	-		2.73	0.91		1.17	0.39	
757	-	-		-	-		-	-		-	-		1.82	1.82		0.78	0.78	
747-400	-	-		-	-		-	-		-	-		3.00	-		1.29	-	
MD-11	-	-		-	-		-	-		-	-		1.17	-		0.50	-	
757	-	-		-	-		-	-		-	-		6.01	-		2.57	-	

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Table J-9b. Assignment of Operations for the International Wayport Alternative (2005)
Page 2 of 2

Aircraft	T1L		T1R		T19L		T19R		A1		A19	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
737-400	-	-	-	-	-	-	-	-	2.73	0.14	1.17	0.06
Saab2000	-	-	-	-	-	-	-	-	4.94	0.82	2.12	0.35
MetroIV	-	-	-	-	-	-	-	-	4.94	0.82	2.12	0.35
COMSEP	-	-	-	-	-	-	-	-	18.11	1.27	7.76	0.54
BEC58P	-	-	-	-	-	-	-	-	5.44	0.30	2.33	0.13
CNA442	-	-	-	-	-	-	-	-	1.12	0.13	0.48	0.05
G-IV	-	-	-	-	-	-	-	-	0.87	0.10	0.37	0.04
CF-5	-	-	-	-	-	-	-	-	0.09	-	0.04	-
CT-33	-	-	-	-	-	-	-	-	0.01	-	0.01	-
CF/FA-18	-	-	-	-	-	-	-	-	0.02	-	0.01	-
CT-114	-	-	-	-	-	-	-	-	0.07	-	0.03	-
F-16	-	-	-	-	-	-	-	-	0.05	-	0.02	-
UH-1	-	-	-	-	-	-	-	-	0.03	-	0.01	-
747-400	0.27	-	0.09	-	0.04	-	0.12	-	-	-	-	-
MD-11	0.27	-	0.09	-	0.04	-	0.12	-	-	-	-	-
757	0.54	-	0.18	-	0.08	-	0.23	-	-	-	-	-
COMSEP	4.53	-	1.51	-	0.65	-	1.94	-	-	-	-	-
BEC58P	0.21	-	0.07	-	0.03	-	0.09	-	-	-	-	-

Table J-9c. Assignment of Operations for the International Wayport Alternative (2015)
Page 1 of 2

Aircraft	D1L		D1S		D1R		D12L		D12S		D12R		D19L		D19S		D19R		D30L		D30S		D30R	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.06	-	0.06	-	0.06	-	-	-	-	-	-	-	0.03	-	0.03	-	0.03	-	-	-	-	-	-	-
MD-11	0.06	-	0.06	-	0.06	-	-	-	-	-	-	-	0.03	-	0.03	-	0.03	-	-	-	-	-	-	-
757	0.12	-	0.12	-	0.12	-	-	-	-	-	-	-	0.05	-	0.05	-	0.05	-	-	-	-	-	-	-
747-400	0.66	0.17	0.66	0.17	0.66	0.17	-	-	-	-	-	-	0.28	0.07	0.28	0.07	0.28	0.07	-	-	-	-	-	-
MD-11	1.25	0.41	1.25	0.41	1.25	0.41	-	-	-	-	-	-	0.53	0.18	0.53	0.18	0.53	0.18	-	-	-	-	-	-
757	0.83	0.83	0.83	0.83	0.83	0.83	-	-	-	-	-	-	0.35	0.35	0.35	0.35	0.35	0.35	-	-	-	-	-	-
747-400	1.53	-	1.53	-	1.53	-	-	-	-	-	-	-	0.65	-	0.65	-	0.65	-	-	-	-	-	-	-
MD-11	0.51	-	0.51	-	0.51	-	-	-	-	-	-	-	0.22	-	0.22	-	0.22	-	-	-	-	-	-	-
757	3.07	-	3.07	-	3.07	-	-	-	-	-	-	-	1.30	-	1.30	-	1.30	-	-	-	-	-	-	-
737-400	1.51	0.08	1.51	0.08	1.51	0.08	-	-	-	-	-	-	0.64	0.03	0.64	0.03	0.64	0.03	-	-	-	-	-	-
Saab2000	2.37	0.39	2.37	0.39	2.37	0.39	-	-	-	-	-	-	1.01	0.17	1.01	0.17	1.01	0.17	-	-	-	-	-	-
MetroIV	2.37	0.39	2.37	0.39	2.37	0.39	-	-	-	-	-	-	1.01	0.17	1.01	0.17	1.01	0.17	-	-	-	-	-	-
COMSEP	6.96	0.54	6.96	0.54	6.96	0.54	0.77	-	0.77	-	0.77	-	2.98	0.23	2.98	0.23	2.98	0.23	0.33	-	0.33	-	0.33	-
BEC58P	2.20	0.14	2.20	0.14	2.20	0.14	0.24	-	0.24	-	0.24	-	0.94	0.06	0.94	0.06	0.94	0.06	0.10	-	0.10	-	0.10	-
CNA442	0.44	0.05	0.44	0.05	0.44	0.05	0.05	-	0.05	-	0.05	-	0.19	0.02	0.19	0.02	0.19	0.02	0.02	-	0.02	-	0.02	-
G-IV	0.31	0.04	0.31	0.04	0.31	0.04	0.03	-	0.03	-	0.03	-	0.13	0.02	0.13	0.02	0.13	0.02	0.01	-	0.01	-	0.01	-
CF-5	0.03	-	0.03	-	0.03	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-
CT-33	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-
CF/FA-18	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-
CT-114	0.02	-	0.02	-	0.02	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-
F-16	0.02	-	0.02	-	0.02	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-
UH-1	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-

K. I. Sawyer AFB Disposal FEIS

Table J-9c. Assignment of Operations for the International Wayport Alternative (2015)
Page 2 of 2

Aircraft	T1L		T1R		T19L		T19R		T30R		T12L		A1		A12		A19		A30	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	-	-	-	-	-	-	-	-	-	-	-	-	0.18	-	-	-	0.08	-	-	-
MD-11	-	-	-	-	-	-	-	-	-	-	-	-	0.18	-	-	-	0.08	-	-	-
757	-	-	-	-	-	-	-	-	-	-	-	-	0.36	-	-	-	0.15	-	-	-
747-400	-	-	-	-	-	-	-	-	-	-	-	-	1.99	0.50	-	-	0.85	0.21	-	-
MD-11	-	-	-	-	-	-	-	-	-	-	-	-	3.74	1.25	-	-	1.60	0.53	-	-
757	-	-	-	-	-	-	-	-	-	-	-	-	2.49	2.49	-	-	1.07	1.07	-	-
747-400	-	-	-	-	-	-	-	-	-	-	-	-	4.60	-	-	-	1.97	-	-	-
MD-11	-	-	-	-	-	-	-	-	-	-	-	-	1.53	-	-	-	0.66	-	-	-
757	-	-	-	-	-	-	-	-	-	-	-	-	9.21	-	-	-	3.95	-	-	-
737-400	-	-	-	-	-	-	-	-	-	-	-	-	4.55	0.24	-	-	1.95	0.10	-	-
Saab2000	-	-	-	-	-	-	-	-	-	-	-	-	7.12	1.19	-	-	3.05	0.51	-	-
MetroIV	-	-	-	-	-	-	-	-	-	-	-	-	7.12	1.19	-	-	3.05	0.51	-	-
COMSEP	-	-	-	-	-	-	-	-	-	-	-	-	20.90	1.63	2.32	-	8.98	0.70	1.00	-
BEC58P	-	-	-	-	-	-	-	-	-	-	-	-	6.61	0.41	0.73	-	2.83	0.17	0.31	-
CNA442	-	-	-	-	-	-	-	-	-	-	-	-	1.31	0.16	0.15	-	0.56	0.07	0.06	-
G-IV	-	-	-	-	-	-	-	-	-	-	-	-	0.92	0.12	0.10	-	0.40	0.05	0.04	-
CF-5	-	-	-	-	-	-	-	-	-	-	-	-	0.09	-	-	-	0.04	-	-	-
CT-33	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	0.01	-	-	-
CF/FA-18	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	0.01	-	-	-
CT-114	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	0.03	-	-	-
F-16	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	0.02	-	-	-
UH-1	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	0.01	-	-	-
747-400	0.40	-	0.13	-	0.06	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
MD-11	0.40	-	0.13	-	0.06	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
757	0.81	-	0.27	-	0.12	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	6.97	-	-	-	-	-	0.33	-	0.77	-	2.99	-	-	-	-	-	-	-	-	-
BEC58P	0.35	-	-	-	-	-	0.02	-	0.04	-	0.15	-	-	-	-	-	-	-	-	-

K. I. Sawyer AFB Disposal FEIS

Surface traffic data used in the modeling were developed from the project traffic study and are shown in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from the same sources as described under the Proposed Action.

1.5 COMMERCIAL AVIATION ALTERNATIVE

The Commercial Aviation Alternative for the reuse of K. I. Sawyer AFB would be centered on a regional commercial airport. As in the Proposed Action, the airfield would be converted to civilian use. Primary components of the aviation action include general aviation operations and commercial passenger operations.

The fleet mix and annual operations for each of the modeled years are contained in Table J-10. The DNL contours for the proposed flight operations and mining operations are presented in Section 4.4.4, Noise. The proposed flight tracks modeled are similar to those for the Proposed Action and are presented in Section 4.4.4. The day-night split for all aircraft operations is given in Table J-3. Stage lengths for air operations are given in Table J-4. It was assumed that there would be no engine runup activity for this alternative.

General aviation operations would be divided into the same general categories as in the Proposed Action. It was assumed that 41 percent of the single-engine and 16 percent of the multi-engine piston general aviation operations would be touch-and-go (or closed loop) activities. Daily operations assigned to each flight track and the time period for the Commercial Aviation Alternative are provided in Table J-11. A standard 3 degree glide slope and the takeoff profiles provided by the FAA's INM Database 4.11 were assumed for all aircraft.

Surface traffic data used in the modeling were developed from the project traffic study and are shown in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from the same sources as described under the Proposed Action.

1.6 RECREATION ALTERNATIVE

This alternative focuses on restoration and conservation of natural resources and includes only non-aviation land uses. The airfield would be replaced with public facilities/recreation and industrial development. Other land uses include institutional, commercial, and residential lands. Surface traffic data used in the modeling were developed from the project traffic study and are presented in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of

Table J-10a. Annual Operations for the Commercial Aviation Alternative (2000)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			11,600	27.4
Beech 1900	2,552	22		
Saab 340	232	2		
ATR-42	8,352	72		
ATR-72	464	4		
General Aviation			30,700	72.6
Single Engine	23,700	77.2		
Multi-engine	5,000	16.3		
Turboprop	1,000	3.3		
Turbojet	1,000	3.3		
Total			42,300	

Table J-10b. Annual Operations for the Commercial Aviation Alternative (2005)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			13,000	27.0
Beech 1900	2,600	20		
Saab 340	650	5		
ATR-42	9,100	70		
ATR-72	650	5		
General Aviation			35,100	73.0
Single Engine	26,500	75.5		
Multi-engine	6,300	17.9		
Turboprop	1,300	3.7		
Turbojet	1,000	2.8		
Total			48,100	

Table J-10c. Annual Operations for the Commercial Aviation Alternative (2015)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			15,500	25.5
Beech 1900	2,325	15		
Saab 340	1,085	7		
ATR-42	10,540	68		
ATR-72	1,550	10		
General Aviation			45,400	74.5
Single Engine	34,000	74.9		
Multi-engine	8,500	18.7		
Turboprop	1,700	3.7		
Turbojet	1,200	2.6		
Total			60,900	

Table J-11a. Assignment of Operations for the Commercial Aviation Alternative (2000)

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night	-	Day	Night	-	Day	Night	-	Day	Night	-	Day	Night	-	Day	Night	-
Beech1900	0.82	-	-	0.82	-	-	0.82	-	-	0.35	-	-	0.35	-	-	0.35	-	-
Saab340	0.08	-	-	0.08	-	-	0.08	-	-	0.03	-	-	0.03	-	-	0.03	-	-
ATR-42	2.57	0.10	-	2.57	0.10	-	2.57	0.10	-	1.10	0.04	-	1.10	0.04	-	1.10	0.04	-
ATR-72	0.15	-	-	0.15	-	-	0.15	-	-	0.06	-	-	0.06	-	-	0.06	-	-
COMSEP	4.32	0.23	-	4.32	0.23	-	4.32	0.23	-	1.85	0.10	-	1.85	0.10	-	1.85	0.10	-
BEC58P	1.22	0.14	-	1.22	0.14	-	1.22	0.14	-	0.52	0.06	-	0.52	0.06	-	0.52	0.06	-
CNA442	0.27	0.05	-	0.27	0.05	-	0.27	0.05	-	0.12	0.02	-	0.12	0.02	-	0.12	0.02	-
G-IV	0.27	0.05	-	0.27	0.05	-	0.27	0.05	-	0.12	0.02	-	0.12	0.02	-	0.12	0.02	-
Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night	-	Day	Night	-	Day	Night	-	Day	Night	-	Day	Night	-	Day	Night	-
Beech1900	2.45	-	-	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saab340	0.23	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ATR-42	7.71	0.30	-	3.30	0.13	-	5.78	-	-	-	-	-	-	-	-	-	-	-
ATR-72	0.44	-	-	0.19	-	-	0.33	-	-	0.11	-	-	0.05	-	-	0.14	-	-
COMSEP	12.96	0.68	-	5.55	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-
BEC58P	3.67	0.41	-	1.57	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
CNA442	0.82	0.14	-	0.35	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
G-IV	0.82	0.14	-	0.35	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	-	-	6.82	-	-	2.27	-	-	0.97	-	-	2.92	-	-
BEC58P	-	-	-	-	-	-	0.54	-	-	0.18	-	-	0.08	-	-	0.23	-	-

K. I. Sawyer AFB Disposal FEIS

Table J-11b. Assignment of Operations for the Commercial Aviation Alternative (2005)

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.83	-		0.83	-		0.83	-		0.36	-		0.36	-		0.36	-	
Saab340	0.21	-		0.21	-		0.21	-		0.09	-		0.09	-		0.09	-	
ATR-42	2.71	0.20		2.71	0.20		2.71	0.20		1.16	0.09		1.16	0.09		1.16	0.09	
ATR-72	0.21	-		0.21	-		0.21	-		0.09	-		0.09	-		0.09	-	
COMSEP	4.83	0.25		4.83	0.25		4.83	0.25		2.07	0.11		2.07	0.11		2.07	0.11	
BEC58P	1.54	0.17		1.54	0.17		1.54	0.17		0.86	0.07		0.86	0.07		0.86	0.07	
CNA442	0.36	0.06		0.36	0.06		0.36	0.06		0.15	0.03		0.15	0.03		0.15	0.03	
G-IV	0.27	0.05		0.27	0.05		0.27	0.05		0.12	0.02		0.12	0.02		0.12	0.02	
Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	2.49	-		1.07	-		-	-		-	-		-	-		-	-	
Saab340	0.63	-		0.27	-		-	-		-	-		-	-		-	-	
ATR-42	8.13	0.60		3.48	0.26		6.10	-		-	-		-	-		-	-	
ATR-72	0.63	-		0.27	-		0.47	-		0.16	-		0.07	-		0.20	-	
COMSEP	14.48	0.76		6.20	0.33		-	-		-	-		-	-		-	-	
BEC58P	4.62	0.52		1.98	0.22		-	-		-	-		-	-		-	-	
CNA442	1.07	0.19		0.46	0.08		-	-		-	-		-	-		-	-	
G-IV	0.82	0.14		0.35	0.06		-	-		-	-		-	-		-	-	
COMSEP	-	-		-	-		7.62	-		2.54	-		1.09	-		3.27	-	
BEC58P	-	-		-	-		0.68	-		0.23	-		0.10	-		0.29	-	

K. I. Sawyer AFB Disposal FEIS

Table J-11c. Assignment of Operations for the Commercial Aviation Alternative (2015)

Aircraft	D1L			D1S			D1R			D19L			D19S			D19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	0.74	-		0.74	-		0.74	-		0.32	-		0.32	-		0.32	-	
Saab340	0.35	-		0.35	-		0.35	-		0.15	-		0.15	-		0.15	-	
ATR-42	3.17	0.20		3.17	0.20		3.17	0.20		1.36	0.09		1.36	0.09		1.36	0.09	
ATR-72	0.49	-		0.49	-		0.49	-		0.21	-		0.21	-		0.21	-	
COMSEP	6.20	0.33		6.20	0.33		6.20	0.33		2.66	0.14		2.66	0.14		2.66	0.14	
BEC58P	2.07	0.23		2.07	0.23		2.07	0.23		0.89	0.10		0.89	0.10		0.89	0.10	
CNA442	0.46	0.08		0.46	0.08		0.46	0.08		0.20	0.03		0.20	0.03		0.20	0.03	
G-IV	0.33	0.06		0.33	0.06		0.33	0.06		0.14	0.02		0.14	0.02		0.14	0.02	

Aircraft	A1			A19			T1L			T1R			T19L			T19R		
	Day	Night		Day	Night		Day	Night		Day	Night		Day	Night		Day	Night	
Beech1900	2.23	-		0.95	-		-	-		-	-		-	-		-	-	
Saab340	1.04	-		0.45	-		-	-		-	-		-	-		-	-	
ATR-42	9.52	0.60		4.08	0.26		7.14	-		-	-		-	-		-	-	
ATR-72	1.48	-		0.64	-		1.11	-		0.37	-		0.16	-		0.48	-	
COMSEP	18.59	0.98		7.97	0.42		-	-		-	-		-	-		-	-	
BEC58P	6.22	0.69		2.67	0.30		-	-		-	-		-	-		-	-	
CNA442	1.39	0.24		0.59	0.10		-	-		-	-		-	-		-	-	
G-IV	0.98	0.17		0.42	0.07		-	-		-	-		-	-		-	-	
COMSEP	-	-		-	-		9.78	-		3.26	-		1.40	-		4.19	-	
BEC58P	-	-		-	-		0.92	-		0.31	-		0.13	-		0.39	-	

residents impacted was determined from the same sources as described under the Proposed Action.

1.7 NO-ACTION ALTERNATIVE

The No-Action Alternative would result in no further use of the base property regardless of whether or not the Air Force retains ownership of the property after closure. The property would not be put to further use. A disposal management team would be provided to ensure base security and maintain the grounds and physical assets, including the existing utilities and structures. There would be no military activities/missions performed on the property identified for disposal. Surface traffic data used in the modeling were developed from the project traffic study and are presented in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from the same sources as described under the Proposed Action.

2.0 NOISE METRICS

Noise, as used in this context, refers to sound pressure variations audible to the ear. The audibility of a sound depends on the amplitude and frequency of the sound and the individual's capability to hear the sound. Whether the sound is judged as noise depends largely on the listener's current activity and attitude toward the sound source, as well as the amplitude and frequency of the sound. The range in sound pressures which the human ear can comfortably detect encompasses a wide range of amplitudes, typically a factor larger than a million. To obtain convenient measurements and sensitivities at extremely low and high sound pressures, sound is measured in units of the dB. The dB is a dimensionless unit related to the logarithm of the ratio of the measured level to a reference level.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly. However, the following shortcut method can be used to combine sound levels:

<u>Difference between two dB values</u>	<u>Add the following to the higher level</u>
0 to 1	3
2 to 3	2
4 to 9	1
10 or more	0

The ear is not equally sensitive at all frequencies of sound. At low frequencies, characterized as a rumble or roar, the ear is not very sensitive while at higher frequencies, characterized as a screech or a whine, the ear is most sensitive. The A-weighted level was developed to measure and report sound levels in a way that would more closely approach how people

perceive the sound. All sound levels reported herein are in terms of A-weighted sound levels (dBA).

Environmental sound levels typically vary with time. This is especially true for areas near airports where noise levels will increase substantially as the aircraft passes overhead and afterwards diminish to typical community levels. Both the Department of Defense and the FAA have specified the following three noise metrics to describe aviation noise.

Day-Night Average Sound Level (DNL) is the 24-hour energy average A-weighted sound level with a 10 dB weighting added to those levels occurring between 10:00 p.m. and 7:00 a.m. the following morning. The 10 dB weighting is a penalty representing the added intrusiveness of noise during normal sleeping hours. DNL is used to determine land use compatibility with noise from aircraft and surface traffic. The expression L_{dn} is often used in equations to designate day-night average sound level.

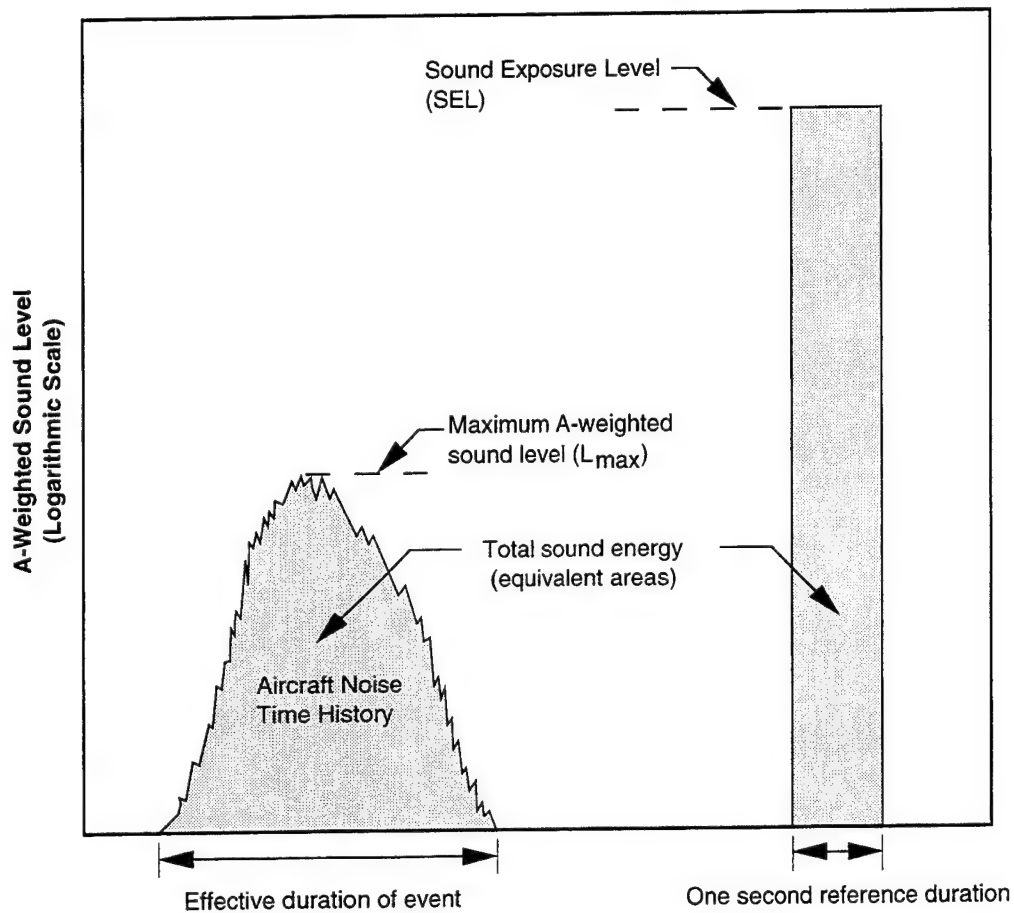
Maximum Sound Level is the highest instantaneous sound level observed during a single noise event no matter how long the sound may persist (Figure J-3).

Sound Exposure Level (SEL) value represents the A-weighted sound level integrated over the entire duration of the event and referenced to a duration of 1 second. Hence, it normalizes the event to a 1-second event. Typically, most events (aircraft flyover) last longer than 1 second, and the SEL value will be higher than the maximum sound level of the event. Figure J-3 illustrates the relationship between the maximum sound level and SEL.

3.0 NOISE MODELS

3.1 AIR TRAFFIC

The FAA-approved INM version 4.11 is a computerized overflight noise prediction model originally developed by the Transportation Systems Center of the U.S. Department of Transportation. This model has been specified as acceptable for FAA-funded Part 150 noise studies. The model accounts for separate aircraft flying along flight tracks defined as straight-line or curved segments, during an annual average 24-hour period at an airport. These flight tracks are coupled with separate tables in the computer program's data base relating to the noise, velocity, distance, and engine thrust for each district aircraft type selected. The individual aircraft noise exposures are then summed for each location on a grid around the airport. The cumulative values of noise exposure at each grid location may then be used to interpolate equal noise exposure contours for preselected DNL values.



**Sound Exposure Level
and Comparison to
Aircraft Noise Time
History**

Figure J-3

3.2 SURFACE TRAFFIC

The FHWA Highway Traffic Noise Prediction Noise Model was used to predict surface traffic noise. The model uses traffic volumes, vehicular mix, traffic speed, traffic distribution, and roadway length to estimate traffic noise levels.

4.0 ASSESSMENT CRITERIA

Criteria for assessing the effects of noise include annoyance, speech interference, sleep disturbance, noise-induced hearing loss, possible nonauditory health effects, reaction by animals, and land use compatibility. These criteria are often developed using statistical methods. The validity of generalizing statistics derived from large populations is suspect when these statistics are applied to small sample sizes as they have been in the affected areas near K. I. Sawyer AFB. Caution should be employed when interpreting the results of the impact analysis.

4.1 ANNOYANCE DUE TO SUBSONIC AIRCRAFT NOISE

Noise-induced annoyance is an attitude or mental process with both acoustic and nonacoustic determinants (Fidell et al., 1988). Noise-induced annoyance is perhaps most often defined as a generalized adverse attitude toward noise exposure. Noise annoyance is affected by many factors including sleep and speech interference and task interruption. The level of annoyance may also be affected by many nonacoustic factors.

In communities in which the prevalence of annoyance is affected primarily by noise, reductions in exposure can be expected to lead to reductions in prevalence of annoyance. In communities in which the prevalence of annoyance is controlled by nonacoustic factors, such as odor, traffic congestion, etc., there may be little or no reduction in annoyance associated with reductions in exposure. The intensity of community response to noise exposure may even, in some cases, be essentially independent of physical exposure. In the case of community response to actions, such as airport siting or scheduling of supersonic transport aircraft, vigorous reaction has been encountered at the mere threat of exposure, or minor increases in exposure.

The standard method for determining the prevalence of annoyance in noise-exposed communities is by attitudinal survey. Surveys generally solicit self-reports of annoyance through one or more questions of the form "How bothered or annoyed have you been by the noise of (noise source) over the last (time period)?" Respondents are typically constrained in structured interviews to select one of a number of response alternatives, often named categories such as "Not At All Annoyed," "Slightly Annoyed," "Moderately Annoyed," "Very Annoyed," or "Extremely Annoyed." Other means are

sometimes used to infer the prevalence of annoyance from survey data (for example, by interpretation of responses to activity interference questions or by construction of elaborate composite indices), with varying degrees of face validity and success.

Predictions of the prevalence of annoyance in a community can be made by extrapolation from an empirical dosage-effect relationship. Based on the results of a number of sound surveys, Schultz (1978) developed a relationship between percent highly annoyed and DNL:

$$\% \text{ Highly Annoyed} = 0.8553 \text{ DNL} - 0.0401 \text{ DNL}^2 + 0.00047 \text{ DNL}^3$$

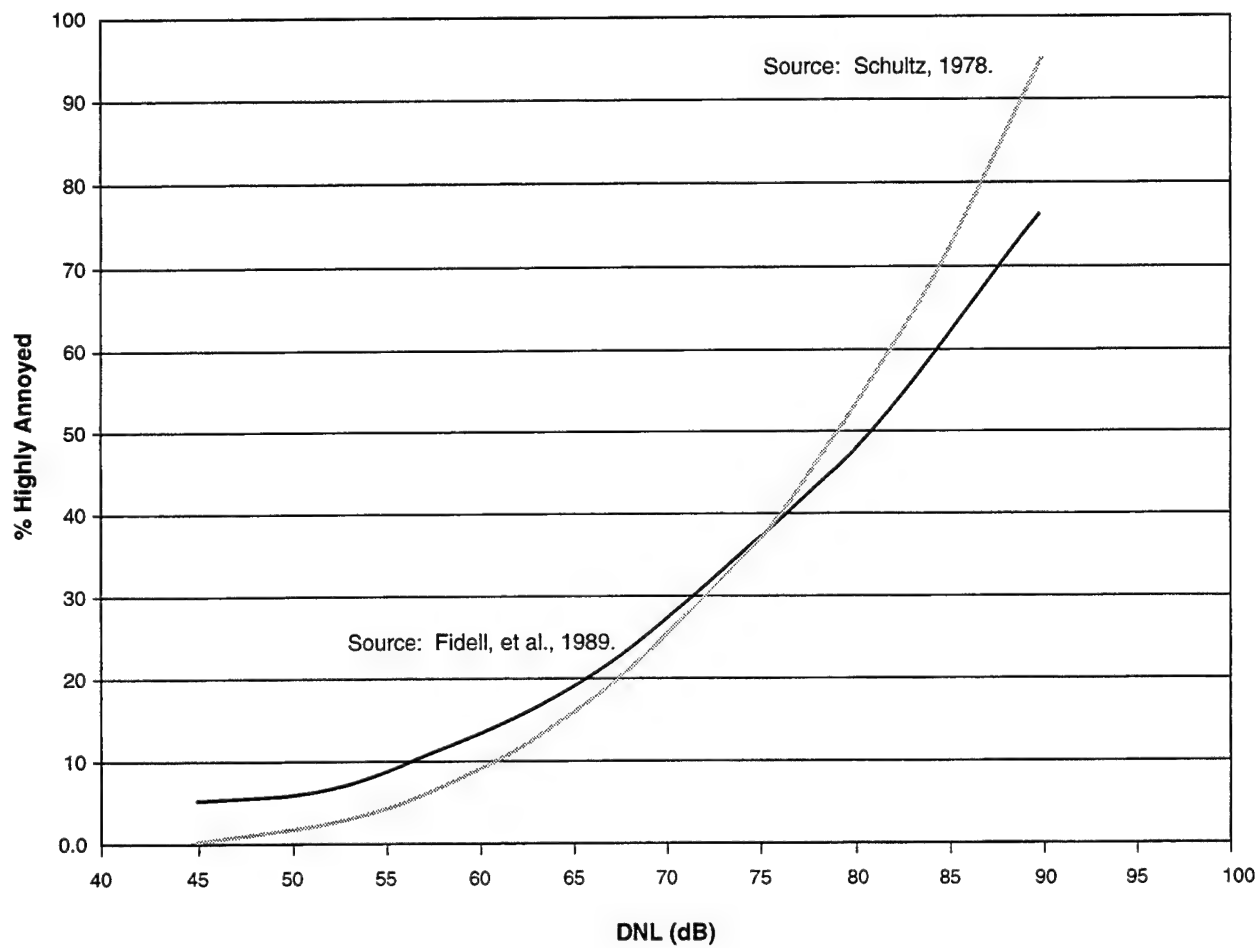
Note that this relationship should not be evaluated outside the range of DNL = 45 to 90 dB. Figure J-4 presents this equation graphically. Less than 15 to 20 percent of the population would be predicted to be annoyed by DNL values less than 65 dB, whereas over 37 percent of the population would be predicted to be annoyed from DNL values greater than 75 dB. The relationship developed by Schultz was presented in the Guidelines for Preparing Environmental Impact Statements on Noise (National Academy of Science, 1977).

These results were recently reviewed (Fidell et al., 1989) and the original findings were updated with the results of more recent social surveys, bringing the number of data points used in defining the relationship to over 400. The findings of the new study differ only slightly from those of the original study.

4.2 SPEECH INTERFERENCE AND RELATED EFFECTS DUE TO AIRCRAFT FLYOVER NOISE

One of the ways that noise affects daily life is by preventing or impairing speech communication. In a noisy environment, understanding of speech is diminished by masking of speech signals by intruding noises. Speakers generally raise their voices or move closer to listeners to compensate for masking noise in face-to-face communications, thereby increasing the level of speech at the listener's ear. As intruding noise levels rise higher and higher, speakers may cease talking altogether until conversation can be resumed at comfortable levels of vocal effort after noise intrusions end.

If the speech source is a radio or television, the listener may increase the volume during a noise intrusion. If noise intrusions occur repeatedly, the listener may choose to set the volume at a high level so that the program material can be heard even during noise intrusions.



Community Noise Annoyance Curves

Figure J-4

In addition to losing information contained in the masked speech material, the listener may lose concentration because of the interruptions and thus become annoyed. If the speech message is some type of warning, the consequences could be serious.

Current practice in quantification of the magnitude of speech interference and predicting speech intelligibility ranges from metrics based on A-weighted sound pressure levels of the intruding noise alone to more complex metrics requiring detailed spectral information about both speech and noise intrusions. There are other effects of the reduced intelligibility of speech caused by noise intrusions. For example, if the understanding of speech is interrupted, performance may be reduced, annoyance may increase, and learning may be impaired.

As the noise level of an environment increases, people automatically raise their voices. The effect does not take place, however, if the noise event rises to a high level very suddenly.

4.2.1 Speech Interference Effects from Time-Varying Noise

Most research on speech interference due to noise has included the study of steady state noise. As a result, reviews and summaries of noise effects on speech communications concentrate on continuous or at least long duration noises (Miller, 1974). However, noise intrusions are not always continuous or of long duration, but are frequently transient in nature. Transportation noise generates many such noise intrusions, consisting primarily of individual vehicle pass-bys, such as aircraft flyovers. Noise emitted by other vehicles (motorboats, snowmobiles, and off-highway vehicles) is also transient in nature.

It has been shown, at least for aircraft flyover noise, that accuracy of predictors of speech intelligibility is ranked in a similar fashion for both steady state and time-varying or transient sounds (Williams et al., 1971; Kryter and Williams, 1966). Of course, if one measures the noise of a flyover by the maximum A-weighted level, intelligibility associated with this level would be higher than for a steady noise of the same value, simply because the level is less than the maximum for much of the duration of the flyover.

4.2.2 Other Effects of Noise Which Relate to Speech Intelligibility

Aside from the direct effects of reduction in speech intelligibility, related effects may occur that tend to compound the loss of speech intelligibility itself.

Learning. One of the environments in which speech intelligibility plays a critical role is the classroom. In classrooms of schools exposed to aircraft

flyover noise, speech becomes masked or the teacher stops talking altogether during an aircraft flyover (Crook and Langdon, 1974). Pauses begin to occur when instantaneous flyover levels exceed 60 dB. Masking of the speech of teachers who do not pause starts at about the same level.

At levels of 75 dB some masking occurs for 15 percent of the flyovers and increases to nearly 100 percent at 82 dB. Pauses occur for about 80 percent of the flyovers at this noise level. Since a marked increase in pauses and masking occurs when levels exceed 75 dB, this level is sometimes considered as one above which teaching is impaired due to disruption of speech communication. The effect that this may have on learning is unclear at this time. However, one study (Arnoult et al., 1986) could find no effect of noise on cognitive tasks from jet or helicopter noise over a range from 60 to 80 dB (A-level), even though intelligibility scores indicated a continuous decline starting at the 60 dB level. In a Japanese study (Ando et al., 1975) researchers failed to find differences in mental task performance among children from communities with different aircraft noise exposure.

Although there seems to be no proof that noise from aircraft flyovers affects learning, it is reported by Mills (1975) that children are not as able to understand speech in the presence of noise as are adults. It is hypothesized that part of the reason is due to the increased vocabulary which the adult can draw on as compared to the more limited vocabulary available to the young student. Also, when one is learning a language, it is more critical that all words be heard rather than only enough to attain 95 percent sentence intelligibility, which may be sufficient for general conversations. It was mentioned above that when the maximum A-level for aircraft flyovers heard in a classroom exceeds 75 dB, masking of speech increases rapidly. However, it was also noted that pausing during flyovers and masking of speech for those teachers who continue to lecture during a flyover start at levels around 60 dB (Pearsons and Bennett, 1974).

Animals. Literature concerning the effects of noise on animals is not large, and most of the studies have focused on the relation between dosages of continuous noise and effects (Belanovskii and Omel'yanenko, 1982; Ames, 1974). A literature survey (Kull and Fisher, 1986) found that the literature is inadequate to document long-term or subtle effects of noise on animals. No controlled study has documented any serious accident or mortality on livestock despite extreme exposure to noise.

Annoyance. Klatt, Stevens, and Williams (1969) studied the annoyance of speech interference by asking people to judge the annoyance of aircraft noise in the presence and absence of speech material. The speech material was composed of passages from newspaper and magazine articles. In addition to rating aircraft noise on an acceptability scale (unacceptable, barely acceptable, acceptable, and of no concern), the subjects were

required to answer questions about the speech material. The voice level was considered to represent a raised voice level (assumed to be 68 dB). In general, for the raised voice talker, the rating of barely acceptable was given to flyover noise levels of 73 to 76 dB. However, if the speech level was reduced, the rating of the aircraft tended more toward unacceptable. The results suggested that if the speech level were such that 95 percent or better sentence intelligibility was maintained, then a barely acceptable rating or better acceptability rating could be expected. This result is in general agreement with the finding in schools that teachers pause or have their speech masked at levels above 75 dB (Crook and Langdon, 1974).

Hall, Taylor, and Birnie (1985) recently tried to relate various types of activity interference in the home, related to speech and sleeping, to annoyance. The study found that there is a 50 percent chance that people's speech would be interfered with at a level of 58 dB. This result is in agreement with the other results, considering that the speech levels in the school environment of the Cook study are higher than the levels typically used in the home. Also, in a classroom situation the teacher raises his or her voice as the flyover noise increases in intensity.

4.2.3 Predicting Speech Intelligibility and Related Effects Due to Aircraft Flyover Noise

It appears from the above discussions that when aircraft flyover noises exceed approximately 60 dB, speech communication may be interfered with either by masking or by pausing on the part of the talker. Increasing the level of the flyover noise to 80 dB would reduce the intelligibility to zero even if a loud voice is used by those attempting to communicate.

The levels mentioned above refer to noise levels measured indoors. The same noises measured outdoors would be 15 to 25 dB higher than these indoor levels during summer (windows open) and winter months (windows closed), respectively. These estimates are taken from Environmental Protection Agency (EPA) reviews of available data (U.S. EPA, 1974).

Aircraft noise levels measured inside dwellings and schools near the ends of runways at airports may exceed 60 dB (75 dB outside). During flyovers, speech intelligibility would be degraded. However, since the total duration is short, no more than a few seconds during each flyover, only a few syllables may be lost. People may be annoyed, but the annoyance may not be due to loss in speech communication, but rather to startle or sleep disturbance as discussed below.

4.3 SLEEP DISTURBANCE DUE TO NOISE

The effects of noise on sleep have long been a concern of parties interested in assuring suitable residential noise environments. Early studies noted background levels in people's bedrooms in which sleep was apparently undisturbed by noise. Various levels between 25 to 50 dB were observed to be associated with an absence of sleep disturbance. The bulk of the research on noise effects on which the current relationship is based was conducted in the 1970s. The tests were conducted in a laboratory environment in which awakening was measured either by a verbal response or by a button push, or by brain wave recordings (electroencephalograms) indicating stages of sleep (and awakening). Various types of noise were presented to the sleeping subjects throughout the night. These consisted primarily of transportation noises, including those produced by aircraft, trucks, cars and trains. The aircraft noises included both flyover noises and sonic booms. Synthetic noises, including laboratory-generated sounds consisting of shaped noises and tones, were also studied.

Lukas (1975) and Goldstein and Lukas (1980) both reviewed data available in the 1970s on sleep-stage changes and waking effects of different levels of noise. Since no known health effects were associated with either waking or sleep-stage changes, either measure was potentially useful as a metric of sleep disturbance. However, since waking, unlike sleep-stage changes, is simple to quantify, it is often selected as the metric for estimating the effects of noise on sleep. These two reviews showed great variability in the percentage of people awakened by exposure to noise. The variability is not merely random error, but reflects individual differences in adaptation or habituation, and also interpretation of the meaning of the sounds. Such factors cannot be estimated from the purely acoustic measures in noise exposure.

Another major review, by Griefahn and Muzet (1978), provided similar information for effects of noise on waking. However, Griefahn and Muzet's results suggested less waking for a given level of noise than predicted by Lukas.

A recent review (Pearsons et al., 1989) of the literature related to sleep disturbance demonstrated that the relationship, based exclusively on laboratory studies, predicts greater sleep disturbance than that likely to occur in a real-life situation in which some adaptation has occurred. The prediction relationships developed in this review should not be considered to yield precise estimates of sleep disturbance because of the great variability in the data sets from which they were developed. The relationships include only the duration and level components of "noise exposure." Increasing the precision of prediction would depend on quantification of some of the nonacoustic factors. Further, a recent review of field as well as laboratory

studies suggests that habituation may reduce the effect of noise on sleep (Pearsons et al., 1989).

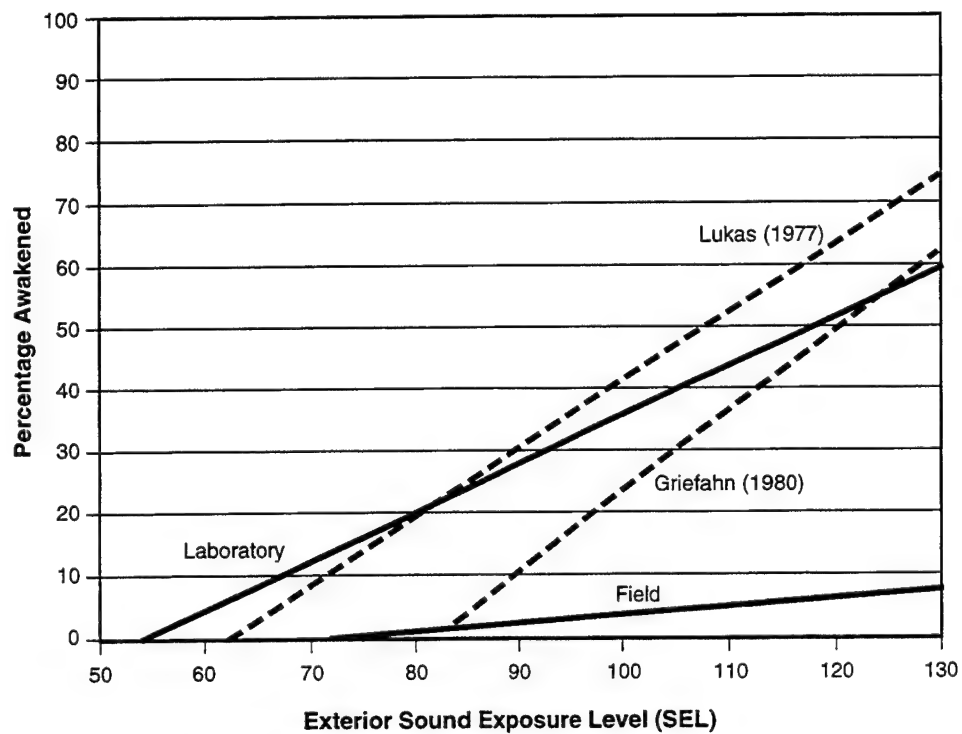
Noise must penetrate the home to disturb sleep. Interior noise levels are lower than exterior levels due to the attenuation of the sound energy by the structure. The amount of attenuation provided by the building is dependent on the type of construction and whether the windows are open or closed. The approximate national average attenuation factors are 15 dB for open windows and 25 dB for closed windows (U.S. EPA, 1974).

Incorporating these attenuation factors, the percent awakened relationships previously discussed under summer conditions are presented in Figure J-5. In conclusion, the scientific literature does not provide a consensus on sleep disturbance. There is no recognized criteria or standard which provides guidance to assess sleep disturbance due to noise.

4.4 NOISE-INDUCED HEARING LOSS

Hearing loss is measured in decibels and refers to the permanent auditory threshold shift of an individual's hearing in an ear. Auditory threshold refers to the minimum acoustic signal that evokes an auditory sensation, i.e., the quietest sound a person can hear. When a threshold shift occurs a person's hearing is not as sensitive as before, and the minimum sound that a person can hear must be louder. The threshold shift that naturally occurs with age is called presbycusis. Exposure to high levels of sound can cause temporary and permanent threshold shifts usually referred to as noise-induced hearing loss. Permanent hearing loss is generally associated with destruction of the hair cells of the inner ear.

The U. S. EPA (1974) and the Committee on Hearing, Bioacoustics, and Biomechanics (National Academy of Sciences, 1981) have addressed the risk of outdoor hearing loss. They have concluded that hearing loss would not be expected for people living outside the DNL 75 dB noise contour. Several studies of populations near existing airports in the U.S. and the U.K. have shown that the possibility for permanent hearing loss in communities near intense commercial take-off and landing patterns is remote. An FAA-funded study compared the hearing of the population near the Los Angeles International Airport to that of the population in a quiet area away from aircraft noise (Parnel et al., 1972). A similar study was performed in the vicinity of London Heathrow Airport (Ward et al., 1972). Both studies concluded that there was no significant difference between the hearing loss of the two populations, and no correlation between the hearing level with the length of time people lived in the airport neighborhood.



Source: Pearsons, et al., 1989

Sleep Disruption (Awakening)

Figure J-5

4.5 NONAUDITORY HEALTH EFFECTS OF RESIDENTIAL AIRCRAFT NOISE

Based on summaries of previous research in the field (Thompson, 1981; Thompson and Fidell, 1989), predictions of nonauditory health effects of aircraft noise cannot be made. A valid predictive procedure requires: (1) evidence for causality between aircraft noise exposure and adverse nonauditory health consequences, and (2) knowledge of a quantitative relationship between amounts of noise exposure (dose) and specific health effects. Because results of studies of aircraft noise on health are equivocal, there is no sound scientific basis for making adequate risk assessments. Alleged nonauditory health consequences of aircraft noise exposure that have been studied include birth defects, low birth weight, psychological illness, cancer, stroke, hypertension, sudden cardiac death, myocardial infarction, and cardiac arrhythmias. Of these, hypertension is the most biologically plausible effect of noise exposure. Noise appears to cause many of the same biochemical and physiological reactions, including temporary elevation of blood pressure, as do many other environmental stressors. These temporary increases in blood pressure are believed to lead to a gradual resetting of the body's blood pressure control system. Over a period of years, permanent hypertension may develop (Peterson et al., 1984).

Studies of residential aircraft noise have produced contradictory results. Early investigations indicated that hypertension was from two to four times higher in areas near airports than in areas located away from airports (Karagodina et al., 1969). Although Meecham and Shaw (1988) continue to report excessive cardiovascular mortality among individuals 75 years or older living near the Los Angeles International Airport, their findings cannot be replicated (Frerichs et al., 1980). In fact, noise exposure increased over the years while there was a decline in all cause, age-adjusted death rates and inconsistent changes in age-adjusted cardiovascular, hypertension, and cerebrovascular disease rates.

Studies that have controlled for multiple factors have shown no, or a very weak, association between noise exposure and nonauditory health effects. This observation holds for studies of occupational and traffic noise as well as for aircraft noise exposure. In contrast to the early reports of two- to six-fold increases in hypertension due to high industrial noise (Thompson and Fidell, 1989), the more rigorously controlled studies of Talbott et al. (1985) and van Dijk et al (1987) show no association between hypertension and prolonged exposure to high levels of occupational noise.

In the aggregate, studies indicate that no association exists between street traffic noise and blood pressure or other cardiovascular changes. Two large prospective collaborative studies of heart disease are of particular interest. To date, cross-sectional data from these cohorts offer contradictory results. Data from one cohort show a slight increase in mean systolic blood pressure (2.4 millimeters of mercury) in the noisiest compared to the quietest area;

while data from the second cohort show the lowest mean systolic blood pressure and highest high-density lipoprotein cholesterol (lipoprotein protective of heart disease) for men in the noisiest area (Babisch and Gallacher, 1990). These effects of traffic noise on blood pressure and blood lipids were more pronounced in men who were also exposed to high levels of noise at work.

It is clear from the foregoing that the current state of technical knowledge cannot support inference of a causal or consistent relationship, nor a quantitative dose-response, between residential aircraft noise exposure and health consequences. Thus, no technical means are available for predicting extra-auditory health effects of noise exposure. This conclusion cannot be construed as evidence of no effect of residential aircraft noise exposure on nonauditory health. Current findings, taken in sum, indicate only that further rigorous studies are needed.

4.6 DOMESTIC ANIMALS AND WILDLIFE

A recent study was published on the effects of aircraft noise on domestic animals which provided a review of the literature and a review of 209 claims pertinent to aircraft noise over a period spanning 32 years (Bowles et al., 1990). Studies since the late 1950s were motivated both by public concerns about what was at that time a relatively novel technology, supersonic flight, and by claims leveled against the U. S. Air Force for damage done to farm animals by very low-level subsonic overflights. Since that time over 40 studies of aircraft noise and sonic booms, both in the U.S. and overseas, have addressed acute effects, including effects of startle responses (sheep, horses, cattle, fowl), and effects on reproduction and growth (sheep, cattle, fowl, swine), parental behaviors (fowl, mink), milk letdown (dairy cattle, dairy goats, swine), and egg production.

The literature on the effects of noise on domestic animals is not large, and most of the studies have focused on the relation between dosages of continuous noise and effects. Chronic noises are not a good model for aircraft noise, which lasts only a few seconds, but which is often very startling. The review of claims suggests that a major source of loss was panics induced in naive animals.

Aircraft noise may have effects because it might trigger a startle response, a sequence of physiological and behavioral events that once helped animals avoid predators. There are good dose-response relations describing the tendency to startle to various levels of noise, and the effect of habituation on the startle response.

The link between startles and serious effects (i.e., effects on productivity) is less certain. Here, we will define an effect as any change in a domestic animal that alters its economic value, including changes in body weight or

weight gain, numbers of young produced, weight of young produced, fertility, milk production, general health, longevity, or tractability. At this point, changes in productivity are usually considered an adequate indirect measure of changes in well being, at least until objective legal guidelines are provided.

Recent focus on the effects on production runs counter to a trend in the literature toward measuring the relation between noise and physiological effects, such as changes in corticosteroid levels, and in measures of immune system function. As a result, it is difficult to determine the relation between dosages of noise and serious effects using only physiological measures. The experimental literature is inadequate to document long-term or subtle effects resulting from exposure to aircraft noise.

4.7 LAND USE COMPATIBILITY GUIDELINES

Widespread concern about the noise impacts of aircraft noise essentially began in the 1950s, a decade that saw the major introduction of high power jet aircraft into military service. The concern about noise impacts in the communities around airbases, and also within the airbases themselves, led the Air Force to conduct major investigations into the noise properties of jets, methods of noise control for test operations, and the effects of noise from aircraft operations in communities surrounding airbases. These studies established an operational framework of investigation and identified the basic parameters affecting community response to noise. These studies also resulted in the first detailed procedures for estimating community response to aircraft noise (Stevens and Pietrasanta, 1957).

Although most attention was given to establishing methods of estimating residential community response to noise (and establishing the conditions of noise "acceptability" for residential use), community development involves a variety of land uses with varying sensitivity to noise. Thus, land planning with respect to noise requires the establishment of noise criteria for different land uses. This need was met with the initial development of aircraft noise compatibility guidelines for varied land uses in the mid-1960s (Bishop, 1964).

In residential areas, noise intrusions generate feelings of annoyance on the part of individuals. Increasing degrees of annoyance lead to the increasing potential for complaints and community actions (most typically, threats of legal actions, drafting of noise ordinances, etc.). Annoyance is based largely upon noise interference with speech communication, listening to radio and television, and sleep. Annoyance in the home may also be based upon dislike of "outside" intrusions of noise even though no specific task is interrupted.

Residential land use guidelines have developed from consideration of two related factors:

- (a) Accumulated case history experience of noise complaints and community actions near civil and military airports;
- (b) Relationships between environmental noise levels and degrees of annoyance (largely derived from social surveys in a number of communities).

In the establishment of land use guidelines for other land uses, the prime consideration is task interference. For many land uses, this translates into the degree of speech interference, after taking into consideration the importance of speech communication and the presence of non-aircraft noise sources related directly to the specific land use considered. For some noise-sensitive land uses where any detectable noise signals that rise above the ambient noise are unwanted (such as music halls), detectability may be the criterion rather than speech interference.

A final factor to be considered in all land uses involving indoor activities is the degree of noise insulation provided by the building structures. The land use guideline limits for unrestricted development within a specific land use assume noise insulation properties provided by typical commercial building construction. The detailed land use guidelines may also define a range of higher noise exposure where construction or development can be undertaken, provided a specified amount of noise insulation is included in the buildings. Special noise studies, undertaken by architectural or engineering specialists, may be needed to define the special noise insulation requirements for construction in these guideline ranges.

Estimates of total noise exposure resulting from aircraft operations, as expressed in DNL values, can be interpreted in terms of the probable effect on land uses. Suggested compatibility guidelines for evaluating land uses in aircraft noise exposure areas were originally developed by the FAA as presented in Section 3.4.4, Noise. Part 150 of the FAA regulations prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs. It prescribes the use of yearly DNL in the evaluation of airport noise environments. It also identifies those land use types that are normally compatible with various levels of noise exposure. Compatible or incompatible land use is determined by comparing the predicted or measured DNL level at a site with the values given in the table. The guidelines reflect the statistical variability of the responses of large groups of people to noise. Therefore, any particular level might not accurately assess an individual's perception of an actual noise environment.

While the FAA guidelines specifically apply to aircraft noise, it should be noted that DNL is also used to describe the noise environment due to other community noise sources, including motor vehicles and railroads. The use of DNL is endorsed by the scientific community to assess land use compatibility as it pertains to noise (American National Standards Institute, 1990). Hence, the land use guidelines presented by the FAA can also be used to assess the noise impact from community noise sources other than aircraft.

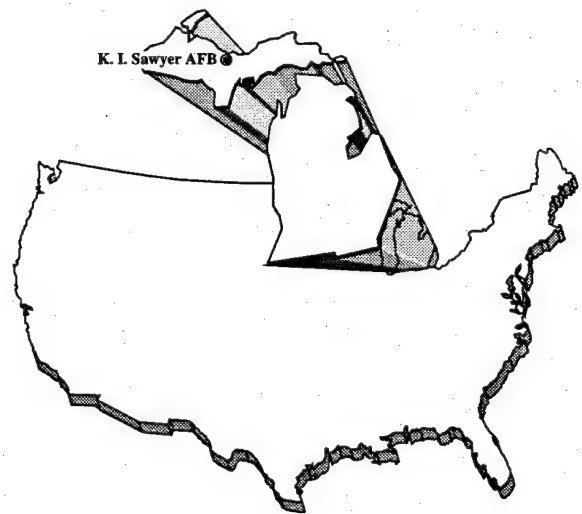
REFERENCES

- American National Standards Institute, 1990. Sound Level Descriptors for Determination of Compatible Land Use, ANSI S12.40-1990.
- Ames, D., 1974. Sound Stress and Meat Animals, Proceedings of the International Livestock Environment Symposium, Lincoln, Nebraska, pp. 324-330.
- Ando, Y., Y. Nakane, and J. Egawa, 1975. Effects of Aircraft Noise on the Mental Work of Pupils, Journal of Sound and Vibration, 43(4), pp. 683-691.
- Anton-Guirgis, H., B. Culver, S. Wang, and T. Taylor, 1986. Exploratory Study of the Potential Effects of Exposure to Sonic Boom on Human Health, Vol 2: Epidemiological Study, Report No. AAMRL-TR-86-020.
- Arnoult, M.D., L.G. Gillfillan, and J. W. Voorhees, 1986. Annoyingness of Aircraft Noise in Relation to Cognitive Activity, Perceptual and Motor Skills, 63, pp. 599-616.
- Babisch, W., and J. Gallacher, 1990. Traffic Noise, Blood Pressure and Other Risk Factors - The Caerphilly and Speedwell Collaborative Heart Disease Studies. Noise '88: New Advances in Noise Research pp. 315-326, Council for Building Research Stockholm, Sweden, Swedish.
- Belanovskii, A., and V.A. Omel'yanenko, 1982. Acoustic Stress in Commercial Poultry Production, Soviet Agricultural Science, 11, 60-62.
- Bennett, R. and Pearsons, K.S., 1981. Handbook of Aircraft Noise Metrics, Report No. NASA CR-3406, National Aeronautics and Space Administration, Washington, DC.
- Bishop, D.E., 1964. Development of Aircraft Noise Compatibility for Varied Land Uses, FAA SRDS Report RD-64-148, II.
- Bowles, A.E., P.K. Yochem, and F.T. Awbrey 1990. The Effects of Aircraft Overflights and Sonic Booms on Domestic Animals, NSBIT Technical Operating Report No. 13, BBN Laboratories Inc.
- Crook, M.A., and F.J. Langdon, 1974. The Effects of Aircraft Noise on Schools around London Airport, Journal of Sound and Vibration, 34(2), pp. 221-232.
- van Dijk, F.J.H., A.M. Souman, and F.F. de Fries, 1987. Nonauditory Effects of Noise in Industry, Vol. I: A Final Field Study in Industry, International Archives of Occupational and Environmental Health, 59, pp. 133-145.
- Federal Aviation Administration, 1993. Integrated Noise Model Version 4.11 User's Guide Supplement, DOT/FAA/EE/ 92102.
- Federal Highway Administration, 1978. Highway Traffic Noise Prediction Model, Report No. FHWA-RD-77-118.

- Fidell, S., T.J. Schultz, and D.M. Green, 1988. A Theoretical Interpretation of the Prevalence Rate of Noise-Induced Annoyance in Residential Populations, Journal of the Acoustical Society of America, 84(6).
- Fidell, S., D. Barber, and T. Schultz, 1989. Updating a dosage-effect relationship for the prevalence of annoyance due to general transportation noise, in Noise and Sonic Boom Impact Technology, Human Systems Division, Air Force Systems Command, Brooks Air Force Base, Texas (HSD-TR-89-009).
- Frerichs, R.R., B.L. Beeman, and A.H. Coulson, 1980. Los Angeles Airport Noise and Mortality - Faulty Analysis and Public Policy, American Journal of Public Health, 70, pp. 357-362.
- Goldstein, J., and J. Lukas, 1980. Noise and Sleep: Information Needs for Noise Control, Proceedings of the Third International Congress on Noise as a Public Health Problem, ASHA Report No. 10, pp 442-448.
- Griefahn, B., 1980. Research on noise disturbed sleep since 1973. Proceedings of the Third International Congress on Noise as a Public Health Problem, ASHA Report No. 10, pp. 377-390.
- Griefahn, B., and A. Muzet, 1978. Noise Induced Sleep Disturbance and Their Effects on Health, Journal of Sound Vibration, 59 (1), pp. 99-106.
- Hall, F., S. Taylor, and S. Birnie, 1985. Activity Interference and Noise Annoyance, Journal of Sound and Vibration, 103(2).
- Karagodina, I.L., S.A. Soldatkina, I.L. Vinokur, and A.A. Klimukhin, 1969. Effect of Aircraft Noise on the Population Near Airports, Hygiene and Sanitation, 34, pp. 182-187.
- Klatt, M., K. Stevens, and C. Williams, 1969. Judgments of the Acceptability of Aircraft Noise in the Presence of Speech, Journal of Sound and Vibration, 9(2), pp. 263-275.
- Kryter, K.D., and C.E. Williams, 1966. Masking of Speech by Aircraft Noise, Journal of the Acoustical Society of America, 39, pp. 138-150.
- Kull, R.C., and A.D. Fisher, 1986. Supersonic and Subsonic Aircraft Noise Effects on Animals: A Literature Survey (AAMRL-TR-87-032), Noise and Sonic Boom Impact Technology ADPO, Human Systems Division, Air Force Systems Command, Wright-Patterson AFB, Ohio.
- Lukas, J., 1975. Noise and Sleep: A Literature Review and a Proposed Criterion for Assessing Effect, Journal of the Acoustical Society of America, 58(6).
- Lukas, J., 1977. Measures of noise level: Their relative accuracy in predicting objective and subjective responses to noise during sleep. EPA Report No. 600/1-77-010. U.S. Environmental Protection Agency, Washington D.C.

- Meecham, W.C., and N.A. Shaw, 1988. Increase in Disease Mortality Rates Due to Aircraft Noise. Proceedings of the International Congress of Noise as a Public Health Problem, Swedish Council for Building Research, Stockholm, Sweden, 21-25 August.
- Miller, J.D., 1974. Effects of Noise on People. Journal of the Acoustical Society of America, 56(3), pp. 729-764.
- Mills, J.H., 1975. Noise and Children: a Review of Literature, Journal of the Acoustical Society of America, 58(4), pp. 767-779.
- Moulton, Carey L., 1990. Air Force Procedure for Predicting Aircraft Noise Around Airbases: Noise Exposure Model (NOISEMAP) User's Manual, Report AAMRL-TR-90-011, Human Systems Division/Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, February.
- National Academy of Sciences, 1977. Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group on the Committee on Hearing, Bioacoustics, and Biomechanics, National Research Council, Washington, D.C.
- National Academy of Sciences, 1981. The Effects on Human Health from Long-Term Exposure to Noise, Report of Working Group 81, Committee on Hearing, Bioacoustics and Biomechanics, The National Research Council, Washington, DC.
- Parnel, Nagel, and Cohen, 1972. Evaluation of Hearing Levels of Residents Living Near a Major Airport, Report FAA-RD-72-72.
- Pearsons, K., D. Barber, and B. Tabachnick, 1989. Analyses of the Predictability of Noise-Induced Sleep Disturbance, Report No. HSD-TR-89-029, CA BBN Systems and Technologies Corporation, Canoga Park.
- Pearsons, K.S., and R. Bennett, 1974. Handbook of Noise Ratings, Report No. NASA CR-2376, National Aeronautics and Space Administration, Washington, DC.
- Peterson, E.A., J.S. Augenstein, and C.L. Hazelton, 1984. Some Cardiovascular Effects of Noise, Journal of Auditory Research, 24, 35-62.
- Schultz, T.J., 1978. Synthesis of Social Surveys on Noise Annoyance, Journal of the Acoustical Society of America, 64(2), pp. 377-405.
- Stevens, K.N., and A.C. Pietrasanta, 1957. Procedures for Estimating Noise Exposure and Resulting Community Reactions from Air Base Operations, WADC TN-57-10, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.
- Talbott, E., J. Helmkamp, K. Matthews, L. Kuller, E. Cottingham, and G. Redmond, 1985. Occupational Noise Exposure, Noise-Induced Hearing Loss, and the Epidemiology of High Blood Pressure, American Journal of Epidemiology, 121, pp. 501-515.

- Thompson, S.J., 1981. Epidemiology Feasibility Study: Effects of Noise on the Cardiovascular System, Report No. EPA 550/9-81-103.
- Thompson, S., and S. Fidell, 1989. Feasibility of Epidemiologic Research on Nonauditory Health Effects of Residential Aircraft Noise Exposure, BBN Report No. 6738, BBN Systems and Technologies, Canoga Park, California.
- U.S. Air Force, 1993. AICUZ Study K. I. Sawyer AFB Volumes I, II, and III, September.
- U.S. Department of Transportation, 1980. Guidelines for Considering Noise in Land Use Planning and Control, Federal Interagency Committee on Urban Noise, June.
- U.S. Environmental Protection Agency, 1973. Public Health and Welfare Criteria for Noise, Report No. NCD 73.1, Washington, DC, July.
- U.S. Environmental Protection Agency, 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Publication No. 550/9-74-004, Washington, DC, March.
- U.S. EPA. See U.S. Environmental Protection Agency.
- van Dijk, F.J.H., A.M. Souman, and F.F. de Fries, 1987. Nonauditory Effects of Noise in Industry, Vol. I: A Final Field Study in Industry, International Archives of Occupational and Environmental Health, 59, pp. 133-145.
- Ward, Cushing, and Burns, 1972. TTS from Neighborhood Aircraft Noise, Journal of the Acoustical Society of America, 55(1).
- Williams, C.E., K.S. Pearsons, and M.H.L. Hecker, 1971. Speech Intelligibility in the Presence of Time-Varying Aircraft Noise, Journal of the Acoustical Society of America, 56(3).



APPENDIX K

APPENDIX K
BIOLOGICAL RESOURCES

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 1 of 8

Common Name	Scientific Name
Plants	
Balsam fir ^(a)	<i>Abies balsamea</i>
Crimson king maple	<i>Acer platanoides</i>
Norway maple	<i>Acer platanoides columna</i>
Red maple	<i>Acer rubrum</i>
Sugar maple ^(a)	<i>Acer saccharum</i>
Speckled alder	<i>Alnus rugosa</i>
Oblong-leaf juneberry	<i>Amelanchier canadensis</i>
Serviceberry ^(a)	<i>Amelanchier</i> sp.
Weigela	<i>Atro purpurea</i>
Paper birch	<i>Betula papyrifera</i>
Bladder sedge	<i>Carex intumescens</i>
Lurid sedge	<i>Carex lurida</i>
Tussock sedge	<i>Carex stricta</i>
Bristlebract sedge	<i>Carex tribuloides</i>
Fox sedge	<i>Carex vulpinoidea</i>
Leatherleaf shrub	<i>Chamaedaphne calyculata</i>
Varigated dogwood	<i>Cornus alba argentea (marginata)</i>
Bailey's red-twigg dogwood	<i>Cornus baileyi</i>
Bunchberry ^(a)	<i>Cornus canadensis</i>
Moccasin-flower ^(a)	<i>Cypripedium acaule</i>
Tufted hairgrass	<i>Deschampsia cespitosa</i>
Dwarf bush honeysuckle	<i>Diervilla lanicera</i>
Beaked spikerush	<i>Eleocharis rostellata</i>
Water horsetail	<i>Equisetum fluviatile</i>
Big leaf winter creeper	<i>Euonymus fortunei "Vegetus"</i>
Dwarf-winged euonymus	<i>Euronymus alatus compacta</i>
Red fescue	<i>Festuca rubra</i>
Autumn purple ash	<i>Fraxinus americana</i>
Fir clubmoss ^(b)	<i>Huperzia selago</i>
Pennywort	<i>Hydrocotyl</i> sp.
Canada rush	<i>Juncus canadensis</i>
Pfitzer juniper	<i>Juniperus chinensis pfitzeriana</i>
Blue sargent juniper	<i>Juniperus chinensis "Sargent Glauca"</i>
Andorra juniper	<i>Juniperus horizontalis</i>
Japgarden juniper	<i>Juniperus procumbens</i>
Dundee juniper	<i>Juniperus virginiana (hilli)</i>
Pale laurel ^(a)	<i>Kalmia polifolia</i>
American larch (tamarack) ^(a)	<i>Larix laricina</i>
Labrador tea ^(a)	<i>Ledum groenlandicum</i>

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 2 of 8

Common Name	Scientific Name
Duckweed	<i>Lemna</i> sp.
Perennial rye	<i>Lolium</i> sp.
Dolgo crabapple	<i>Malus dolga</i>
Red weeping jade crabapple	<i>Malus</i> sp. "Red Jade"
James' monkey-flower ^(b)	<i>Mimulus glabratus</i> var. <i>jamesii</i>
Water lily ^(a)	<i>Nymphaea</i> sp.
Reed canary grass	<i>Phalaris arundenacia</i>
Phragmites	<i>Phragmites communis</i>
Black spruce ^(a)	<i>Picea mariana</i>
Colorado blue spruce	<i>Picea pungens glauca</i> "Shiner"
Koster's blue spruce	<i>Picea pungens koster</i>
Jack pine ^(a)	<i>Pinus banksiana</i>
Red pine ^(a)	<i>Pinus resinosa</i>
Scotch pine	<i>Pinus sylvestris</i>
Kentucky blue grass	<i>Poa pratensis</i>
Fringed polygala ^(a)	<i>Polygala pauciflora</i>
Balsam poplar	<i>Populus balsamifera</i>
Eastern cottonwood	<i>Populus deltoides</i>
Quaking aspen ^(a)	<i>Populus tremuloides</i>
Potentilla	<i>Potentilla fruticosa</i>
Pin cherry ^(a)	<i>Prunus pensylvanica</i>
Sand cherry ^(a)	<i>Prunus pumila</i>
Canada red cherry (choke cherry)	<i>Prunus virginiana</i> "Shubert"
Douglas fir	<i>Pseudotsuga menziesii</i>
Bracken fern ^(a)	<i>Pteridium aquilinum</i>
Red oak ^(a)	<i>Quercus rubra</i>
Dock	<i>Rumex</i> sp.
Weeping willow	<i>Salix alba tristis</i>
Black willow	<i>Salix nigra</i>
Soft-stem bullrush	<i>Scirpus validus</i>
Mountain ash	<i>Sorbus aucuparia</i> (European)
Sphagnum moss ^(a)	<i>Sphagnum</i> spp.
Chinese lilac	<i>Syringa chinensis</i>
Hatfield yew	<i>Taxus media hatfieldia</i>
Northern white cedar	<i>Thuja occidentalis</i>
Glove arborvitae	<i>Thuja occidentalis globosa</i>
Basswood	<i>Tilia americana</i>
Little leaf linden	<i>Tilia cordata</i>
Greenspire linden	<i>Tilia cordata</i> "Greenspire"
White clover	<i>Trifolium</i> sp.

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 3 of 8

Common Name	Scientific Name
Cattail	<i>Typha latifolia</i>
Late low blueberry ^(a)	<i>Vaccinium vacillans</i>
Cranberry bush	<i>Viburnum trilobum compacta</i>
Invertebrates	
Frigga fritillary ^(b)	<i>Boloria frigga</i>
Fish	
Rockbass	<i>Ambloplites rupestris</i>
Black bullhead	<i>Ameiurus melas</i>
Quillback carpsucker	<i>Carpionodes cyprinus</i>
White sucker	<i>Catostomus commersoni</i>
Cisco	<i>Coregonus artedii</i>
Sculpin	<i>Cottus</i> sp.
Brook stickleback	<i>Culaea inconstans</i>
Common carp	<i>Cyprinus carpo</i>
Northern pike	<i>Esox lucius</i>
Muskellunge	<i>Esox masquinongy</i>
Johnny darter	<i>Etheostoma nigrum</i>
Banded topminnow	<i>Fundulus diaphanus</i>
Brassy minnow	<i>Hybognathus hankinsoni</i>
Lamprey	<i>Ichthyomyzon</i> sp.
Brown bullhead	<i>Ictalurus nebulosus</i>
American brook lamprey	<i>Lampetra appendix</i>
Longnose gar	<i>Lepisosteus osseus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Burbot	<i>Lota lota</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Largemouth bass	<i>Micropterus salmoides</i>
Shorthead redhorse	<i>Moxostoma macrolepidatum</i>
Greater redhorse	<i>Moxostoma valenciennesi</i>
Common shiner	<i>Notropis cornutus</i>
Blacknose shiner	<i>Notropis heterodon</i>
Sand shiner	<i>Notropis stramineus</i>
Mimic shiner	<i>Notropis volucellus</i>
Tadpole madtom	<i>Noturus gyrinus</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>
Yellow perch	<i>Perca flavescens</i>
Logperch	<i>Percina caprodes</i>
Trout perch	<i>Percopsis omiscomaycus</i>

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 4 of 8

Common Name	Scientific Name
Bluntnose minnow	<i>Pimephales notatus</i>
Fathead minnow	<i>Pimephales promelas</i>
Brown trout	<i>Salmo trutta</i>
Brook trout	<i>Salvelinus fontinalis</i>
Creek chub	<i>Semotilus atromaculatus</i>
Pearl dace	<i>Semotilus margarita</i>
Walleye	<i>Stizostedion vitreum</i>
Central mudminnow	<i>Umbra limi</i>
Amphibians	
Spotted salamander	<i>Ambystoma maculatum</i>
American toad	<i>Bufo americanus</i>
Spring peeper	<i>Hyla crucifer</i>
Common gray treefrog	<i>Hyla versicolor</i>
Mudpuppy	<i>Necturus maculosus</i>
Eastern newt	<i>Notophthalmus viridescens</i>
Red-backed salamander	<i>Plethodon cinereus</i>
Striped chorus frog	<i>Pseudacris triseriata</i>
Bullfrog	<i>Rana catesbeiana</i>
Green frog	<i>Rana clamitans</i>
Pickerel frog	<i>Rana palustris</i>
Northern leopard frog	<i>Rana pipiens</i>
Wood frog	<i>Rana sylvatica</i>
Reptiles	
Snapping turtle	<i>Chelydra serpentina</i>
Painted turtle	<i>Chrysemys picta</i>
Wood turtle	<i>Clemmys insculpta</i>
Eastern ringneck snake	<i>Diadophis punctatus</i>
Fox snake	<i>Elaphe vulpina</i>
Blanding's turtle	<i>Emydoidea blandingi</i>
Five-lined skink	<i>Eumeces fasciatus</i>
Smooth green snake	<i>Opheodrys vernalis</i>
Red-bellied snake	<i>Storeria occipitomaculata</i>
Common garter snake	<i>Thamnophis sirtalis</i>
Birds	
Cooper's hawk	<i>Accipiter cooperii</i>
Northern goshawk	<i>Accipiter gentilis</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 5 of 8

Common Name	Scientific Name
Spotted sandpiper ^(a)	<i>Actitis macularia</i>
Northern saw-whet owl	<i>Aegolius acadicus</i>
Red-winged blackbird ^(a)	<i>Agelaius phoeniceus</i>
Wood duck	<i>Aix sponsa</i>
Blue-winged teal	<i>Anas discors</i>
Mallard ^(a)	<i>Anas platyrhynchos</i>
American black duck ^(a)	<i>Anas rubripes</i>
Ruby-throated hummingbird ^(a)	<i>Archilochus colubris</i>
Great blue heron ^(a)	<i>Ardea herodias</i>
Cedar waxwing ^(a)	<i>Bombycilla cedrorum</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Canada goose	<i>Branta canadensis</i>
Great horned owl	<i>Bubo virginianus</i>
Common goldeneye	<i>Bucephala clangula</i>
Red-tailed hawk ^(a)	<i>Buteo jamaicensis</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Broad-winged hawk	<i>Buteo platypterus</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Common redpoll	<i>Carduelis flammea</i>
Pine siskin	<i>Carduelis pinus</i>
American goldfinch ^(a)	<i>Carduelis tristis</i>
Purple finch ^(a)	<i>Carpodacus purpureus</i>
Turkey vulture ^(a)	<i>Cathartes aura</i>
Veery ^(a)	<i>Catharus fuscescens</i>
Hermit thrush ^(a)	<i>Catharus guttatus</i>
Swainson's thrush	<i>Catharus ustulatus</i>
Brown creeper ^(a)	<i>Certhia americana</i>
Belted kingfisher ^(a)	<i>Ceryle alcyon</i>
Chimney swift ^(a)	<i>Chaetura pelagica</i>
Killdeer ^(a)	<i>Charadrius vociferus</i>
Black tern	<i>Chlidonias niger</i>
Common nighthawk	<i>Chordeiles minor</i>
Northern harrier	<i>Circus cyaneus</i>
Evening grosbeak	<i>Coccothraustes vespertinus</i>
Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>
Northern flicker ^(a)	<i>Colaptes auratus</i>
Rock dove	<i>Columba livia</i>
Olive-sided flycatcher	<i>Contopus borealis</i>
Eastern wood-pewee ^(a)	<i>Contopus virens</i>

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 6 of 8

Common Name	Scientific Name
American crow ^(a)	<i>Corvus brachyrhynchos</i>
Common raven	<i>Corvus corax</i>
Blue jay ^(a)	<i>Cyanocitta cristata</i>
Black-throated blue warbler	<i>Dendroica caerulescens</i>
Yellow-rumped warbler ^(a)	<i>Dendroica coronata</i>
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>
Yellow warbler	<i>Dendroica petechia</i>
Black-throated green warbler	<i>Dendroica virens</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Gray catbird	<i>Dumetella carolinensis</i>
Least flycatcher	<i>Empidonax minimus</i>
Willow flycatcher	<i>Empidonax traillii</i>
Horned lark ^(a)	<i>Eremophila alpestris</i>
American kestrel ^(a)	<i>Falco sparverius</i>
American coot ^(a)	<i>Fulica americana</i>
Common snipe	<i>Gallinago gallinago</i>
Common loon	<i>Gavia immer</i>
Common yellowthroat ^(a)	<i>Geothlypis trichas</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Cliff swallow ^(a)	<i>Hirundo pyrrhonota</i>
Barn swallow ^(a)	<i>Hirundo rustica</i>
Northern oriole	<i>Icterus galbula</i>
Dark-eyed junco	<i>Junco hyemalis</i>
Herring gull	<i>Larus argentatus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Hooded merganser	<i>Lophodytes cucullatus</i>
Red crossbill	<i>Loxia curvirostra</i>
Song sparrow ^(a)	<i>Melospiza melodia</i>
Common merganser	<i>Mergus merganser</i>
Red-breasted merganser	<i>Mergus serrator</i>
Black-and-white warbler	<i>Mniotilta varia</i>
Brown-headed cowbird ^(a)	<i>Molothrus ater</i>
Great crested flycatcher	<i>Myiarchus crinitus</i>
Eastern screech owl	<i>Otus asio</i>
Northern parula	<i>Parula americana</i>
Black-capped chickadee ^(a)	<i>Parus atricapillus</i>
Boreal chickadee	<i>Parus hudsonicus</i>
House sparrow ^(a)	<i>Passer domesticus</i>
Savannah sparrow ^(a)	<i>Passerculus sandwichensis</i>
Indigo bunting ^(a)	<i>Passerina cyanea</i>

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 7 of 8

Common Name	Scientific Name
Gray jay	<i>Perisoreus canadensis</i>
Rose-breasted grosbeak ^(a)	<i>Pheucticus ludovicianus</i>
Black-backed woodpecker ^(a)	<i>Picoides arcticus</i>
Downy woodpecker	<i>Picoides pubescens</i>
Hairy woodpecker ^(a)	<i>Picoides villosus</i>
Scarlet tanager	<i>Piranga olivacea</i>
Snow bunting	<i>Plectrophenax nivalis</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
Vesper sparrow	<i>Pooecetes gramineus</i>
Sora	<i>Porzana carolina</i>
Common grackle ^(a)	<i>Quiscalus quiscula</i>
Ruby-crowned kinglet ^(a)	<i>Regulus calendula</i>
Golden-crowned kinglet	<i>Regulus satrapa</i>
Eastern phoebe ^(a)	<i>Sayornis phoebe</i>
Ovenbird	<i>Seiurus aurocapillus</i>
American redstart ^(a)	<i>Setophaga ruticilla</i>
Red-breasted nuthatch	<i>Sitta canadensis</i>
White-breasted nuthatch	<i>Sitta carolinensis</i>
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>
Chipping sparrow ^(a)	<i>Spizella passerina</i>
Barred owl	<i>Strix varia</i>
Eastern meadowlark ^(a)	<i>Sturnella magna</i>
European starling ^(a)	<i>Sturnus vulgaris</i>
Tree swallow ^(a)	<i>Tachycineta bicolor</i>
Brown thrasher ^(a)	<i>Toxostoma rufum</i>
Solitary sandpiper	<i>Tringa solitaria</i>
House wren ^(a)	<i>Troglodytes aedon</i>
American robin ^(a)	<i>Turdus migratorius</i>
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>
Eastern kingbird ^(a)	<i>Tyrannus tyrannus</i>
Nashville warbler ^(a)	<i>Vermivora ruficapilla</i>
Warbling vireo ^(a)	<i>Vireo gilvus</i>
Red-eyed vireo ^(a)	<i>Vireo olivaceus</i>
Solitary vireo	<i>Vireo solitarius</i>
White-throated sparrow	<i>Zonotrichia albicollis</i>
Mammals	
Short-tailed shrew	<i>Blarina brevicauda</i>
Coyote ^(a)	<i>Canis latrans</i>
Beaver ^(a)	<i>Castor canadensis</i>

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
Page 8 of 8

Common Name	Scientific Name
Red-backed vole	<i>Clethrionomys gapperi</i>
Star-nosed mole	<i>Condylura cristata</i>
Big brown bat	<i>Eptesicus fuscus</i>
Porcupine ^(a)	<i>Erethizon dorsatum</i>
Northern flying squirrel	<i>Glaucomys sabrinus</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Red bat	<i>Lasiurus borealis</i>
Hoary bat	<i>Lasiurus cinereus</i>
Snowshoe hare	<i>Lepus americanus</i>
European hare	<i>Lepus europaeus</i>
River otter	<i>Lutra canadensis</i>
Bobcat	<i>Lynx rufus</i>
Woodchuck	<i>Marmota monax</i>
Common striped skunk ^(a)	<i>Mephitis mephitis</i>
Pigmy shrew	<i>Microsorex hoyi</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
House mouse	<i>Mus musculus</i>
Short-tailed weasel	<i>Mustela erminea</i>
Long-tailed weasel	<i>Mustela frenata</i>
Least weasel	<i>Mustela nivalis</i>
Keen's bat	<i>Myotis keeni</i>
Little brown bat	<i>Myotis lucifugus</i>
White-tailed deer ^(a)	<i>Odocoileus virginianus</i>
Muskrat	<i>Ondatra zibethica</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Raccoon ^(a)	<i>Procyon lotor</i>
Norway rat	<i>Rattus norvegicus</i>
Arctic shrew	<i>Sorex arcticus</i>
Masked shrew	<i>Sorex cinereus</i>
Water shrew	<i>Sorex palustris</i>
Eastern cottontail ^(a)	<i>Sylvilagus floridanus</i>
Eastern chipmunk ^(a)	<i>Tamias striatus</i>
Badger	<i>Taxidea taxus</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Black bear	<i>Ursus americanus</i>
Red fox	<i>Vulpes vulpes</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>

Notes: (a) Species or species' sign observed in June 1994 field visit.

(b) State species of special concern identified during 1993-1994 Michigan Natural Features Inventory.

Sources: June 1994 field visit; U.S. Air Force, 1992c; U.S. Air Force, 1993d; USFWS, 1993.

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 1 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Plants			
Climbing fumitory or Allegheny vine	<i>Adlumia fungosa</i>		SC(MI), (WI)
Skinner's gerardia	<i>Agalinis skinneriana</i>	C2	T(MI)
Prairie or pale agoseris	<i>Agoseris glauca</i>		T(MI)
Bluebunch wheatgrass	<i>Agropyron spicatum</i>		X(MI)
Wild chives	<i>Allium schoenoprasum</i>		T(MI)
Round-leaved orchis	<i>Amerorchis rotundifolia</i>		E(MI), T(WI)
Rosy pussytoes	<i>Antennaria rosea</i>		T(MI)
Big-leaf sandwort	<i>Arenaria macrophylla</i>		T(MI)
Dragon's mouth	<i>Arethusa bulbosa</i>		SC(WI)
Three-awned grass	<i>Aristida longespica</i>		T(MI)
Lake cress	<i>Armoracia lacustris</i>	C2	T(MI), E(WI)
Heart-leaved arnica	<i>Arnica cordifolia</i>		T(MI)
Western mugwort	<i>Artemisia ludoviciana</i>		T(MI)
Tall green milkweed	<i>Asclepias hirtella</i>		T(MI)
Dwarf milkweed	<i>Asclepias ovalifolia</i>		E(MI)
Purple milkweed	<i>Asclepias purpurascens</i>		E(WI)
Mountain spleenwort	<i>Asplenium montanum</i>		X(MI)
Wall-rue	<i>Asplenium ruta-muraria</i>		T(MI)
Maidenhair spleenwort	<i>Asplenium trichomanes</i>		SC(WI)
Green spleenwort	<i>Asplenium viride</i>		T(MI), E(WI)
Long-leaved aster	<i>Aster longifolius</i>		SC(MI)
Great northern aster	<i>Aster modestus</i>		T(MI)
Western silvery aster	<i>Aster sericeus</i>		T(MI)
Canadian milk-vetch	<i>Astragalus canadensis</i>		T(MI)
Cooper's milk-vetch	<i>Astragalus neglectus</i>	C2	SC(MI)
Panicled screw-stem	<i>Bartonia paniculata</i>		E(MI)
Screwstem	<i>Bartonia virginica</i>		SC(WI)
Slough grass	<i>Beckmannia syzigachne</i>		T(MI)
Cut-leaved water-parsnip	<i>Berula erecta</i>		T(MI)
Acute-leaved moonwort	<i>Botrychium acuminatum</i>		T(MI)
Prairie moonwort or dunewort	<i>Botrychium campestre</i>		T(MI)
Western moonwort	<i>Botrychium hesperium</i>		T(MI)
Mingan's moonwort	<i>Botrychium minganense</i>		SC(WI)
Goblin moonwort	<i>Botrychium mormo</i>	C2	SC(MI), E(WI)
Blunt-lobed grape fern	<i>Botrychium oneidense</i>		SC(WI)
Ternate grape fern	<i>Botrychium rugulosum</i>		SC(WI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 2 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Side-oats grama grass	<i>Bouteloua curtipendula</i>		T(MI)
Low northern rock-cress	<i>Braya humilis</i>		T(MI)
Pumpelly's brome grass	<i>Bromus pumpellianus</i>		T(MI)
Prairie Indian-plantain	<i>Cacalia plantaginea</i>		T(MI)
Sea rocket	<i>Cakile edentula</i>		SC(WI)
Bog reed grass	<i>Calamagrostis inexpansa</i>		SC(WI)
Northern reedgrass	<i>Calamagrostis lacustris</i>		T(MI)
Narrow-leaved reedgrass	<i>Calamagrostis stricta</i>		T(MI)
Autumnal water-starwort	<i>Callitriche hermaphroditica</i>		SC(MI), (WI)
Large water-starwort	<i>Callitriche heterophylla</i>		T(SC)
Calypso or fairy-slipper	<i>Calypso bulbosa</i>		T(MI), (WI)
Walking fern	<i>Camptosorus rhizophyllus</i>		T(MI)
Cuckoo flower	<i>Cardamine pratensis</i> var. <i>palustris</i>		SC(WI)
Greenish-white sedge	<i>Carex albolutescens</i>		SC(MI)
Sedge	<i>Carex arcta</i>		SC(MI)
Assiniboia sedge	<i>Carex assiniboinensis</i>		T(MI), (WI)
Sedge	<i>Carex atratiformis</i>		T(MI)
Rocky mountain sedge	<i>Carex backii</i>		SC(WI)
Beauty sedge	<i>Carex concinna</i>		SC(MI)
Crawe sedge	<i>Carex crawei</i>		SC(WI)
Davis's sedge	<i>Carex davisii</i>		SC(MI)
Frank's sedge	<i>Carex frankii</i>		SC(MI)
Northern bog sedge	<i>Carex gynocrates</i>		SC(MI)
Hayden's sedge	<i>Carex haydenii</i>		SC(MI)
Hudson Bay sedge	<i>Carex heleonastes</i>		E(MI)
Shore sedge	<i>Carex lenticularis</i>		T(WI)
Livid sedge	<i>Carex livida</i> var. <i>radicaulis</i>		SC(WI)
Sedge	<i>Carex media</i>		T(MI)
Black sedge	<i>Carex nigra</i>		E(MI)
New England sedge	<i>Carex novae-angliae</i>		T(MI)
Pale sedge	<i>Carex pallescens</i>		SC(MI)
Pale sedge	<i>Carex pallescens</i> var. <i>neogaea</i>		SC(WI)
Broad-leaved sedge	<i>Carex platyphylla</i>		T(MI)
Richardson's sedge	<i>Carex richardsonii</i>		SC(MI)
Ross's sedge	<i>Carex rossii</i>		T(MI)
Bulrush sedge	<i>Carex scirpoidea</i>		T(MI)
Sedge	<i>Carex seorsa</i>		T(MI)
Sedge	<i>Carex squarrosa</i>		SC(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 3 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Many-headed sedge	<i>Carex sychnocephala</i>		SC(WI)
Sparse-flowered sedge	<i>Carex tenuiflora</i>		SC(WI)
Sheathed sedge	<i>Carex vaginata</i>		SC(WI)
Wiegand's sedge	<i>Carex wiegandii</i>		T(MI)
Pale Indian paintbrush	<i>Castilleja septentrionalis</i>		T(MI)
Redstem ceanothus or wild lilac	<i>Ceanothus sanguineus</i>		T(MI)
Keweenaw rock-rose	<i>Chamaerhodos nuttallii</i> var. <i>keweenawensis</i>	C2	E(MI)
Flodman's thistle	<i>Cirsium flodmanii</i>		SC(WI)
Hill's thistle	<i>Cirsium hillii</i>	C2	SC(MI), T(WI)
Pitcher's thistle	<i>Cirsium pitcheri</i>	LT	T(MI)
Purple clematis	<i>Clematis occidentalis</i>		SC(MI)
Small blue-eyed mary	<i>Collinsia parviflora</i>		T(MI)
Douglas's hawthorn	<i>Crataegus douglasii</i>		SC(MI)
English sundew	<i>Crosera anglica</i>		SC(MI)
American rock-brake	<i>Cryptogramma acrostichoides</i>		T(MI)
Slender cliff-brake	<i>Cryptogramma stelleri</i>		SC(MI)
Ram's head lady's-slipper	<i>Cypripedium arietinum</i>	3C	SC(MI), T(WI)
Small yellow lady's-slipper	<i>Cypripedium parviflorum</i>		SC(WI)
Showy lady's-slipper	<i>Cypripedium reginae</i>		SC(WI)
Laurentian fragile fern	<i>Cystopteris laurentiana</i>		SC(MI)
False-violet	<i>Dalibarda repens</i>		T(MI)
Flat oat grass	<i>Danthonia compressa</i>		T(MI)
Wild oat-grass	<i>Danthonia intermedia</i>		SC(MI)
Large toothwort	<i>Dentaria maxima</i>		T(MI)
Common hairgrass	<i>Deschampsia flexuosa</i>		SC(WI)
Beak grass	<i>Diarrhena americana</i>		T(MI)
Fairy bells	<i>Disporum hookeri</i>		E(MI)
Shooting-star	<i>Dodecatheon meadia</i>		T(MI)
Rock whitlow-grass	<i>Draba arabisans</i>		T(MI)
Ashy whitlow-grass	<i>Draba cana</i>		T(MI)
Smooth whitlow-grass	<i>Draba glabella</i>		T(MI)
Twisted whitlow-grass	<i>Draba incana</i>		T(MI)
English sundew	<i>Drosera anglica</i>		SC(MI)
Linear-leaved sundew	<i>Drosera linearis</i>		T(WI)
Clinton wood fern	<i>Dryopteris clintoniana</i>		SC(WI)
Expanded woodfern	<i>Dryopteris expansa</i>		SC(MI), (WI)
Male fern	<i>Dryopteris filix-mas</i>		T(MI), SC(WI)
Fragrant cliff woodfern	<i>Dryopteris fragrans</i>		SC(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 4 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Fragrant fern	<i>Dryopteris fragrans remotiuscula</i>		SC(WI)
Flattened spike-rush	<i>Eleocharis compressa</i>		T(MI)
Engelmann's spike-rush	<i>Eleocharis engelmannii</i>		SC(MI)
Black-fruited spike-rush	<i>Eleocharis melanocarpa</i>		SC(MI)
Slender spike-rush	<i>Eleocharis nitida</i>		E(MI)
Capitate spike-rush	<i>Eleocharis olivacea</i>		SC(WI)
Angle-stemmed spike-rush	<i>Eleocharis quadrangulata</i>		E(WI)
Few-flowered spike-rush	<i>Eleocharis quinqueflora</i>		SC(WI)
Robbins spike-rush	<i>Eleocharis robbinsii</i>		SC(WI)
Three-ribbed spike-rush	<i>Eleocharis tricostata</i>		T(MI)
Blue wild-rye	<i>Elymus glaucus</i>		SC(MI)
American dune wild-rye	<i>Elymus mollis</i>		SC(MI)
Black crowberry	<i>Empetrum nigrum</i>		T(MI)
Marsh willow-herb	<i>Epilobium palustre</i>		SC(MI), (WI)
Giant horsetail	<i>Equisetum telmateia</i>		X(MI)
Variegated scouring rush	<i>Equisetum variegatum</i>		SC(WI)
Small love grass	<i>Eragrostis pilosa</i>		SC(MI)
Hyssop-leaved fleabane	<i>Erigeron hyssopifolius</i>		T(MI)
American eyebright	<i>Euphrasia arctica</i>		T(MI)
Rough fescue	<i>Festuca scabrella</i>		T(MI)
Narrow-leaved gentian	<i>Gentiana linearis</i>		T(MI)
Prairie-smoke	<i>Geum triflorum</i>		T(MI)
Wild licorice	<i>Glycyrrhiza lepidota</i>		SC(WI)
Hedge-hyssop	<i>Gratiola lutea</i>		T(MI)
Northern oak fern	<i>Gymnocarpium jessoense</i>		E(MI)
Limestone oak fern	<i>Gymnocarpium robertianum</i>		SC(MI)
Alpine sainfoin	<i>Hedysarum alpinum</i>		E(MI)
Whiskered sunflower	<i>Helianthus hirsutus</i>		SC(MI)
Dwarf-bulrush	<i>Hemicarpha micrantha</i>		SC(MI)
Gentian-leaved St. John's-wort	<i>Hypericum gentianoides</i>		SC(MI)
Dwarf lake iris	<i>Iris lacustris</i>	LT	T(MI)
Whorled pogonia	<i>Isotria verticillata</i>		T(MI)
Twin leaf	<i>Jeffersonia diphylla</i>		SC(MI)
Two-flowered rush	<i>Juncus biflorus</i>		SC(MI)
Short-fruited rush	<i>Juncus brachycarpus</i>		T(MI)
Bayonet rush	<i>Juncus militaris</i>		T(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 5 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Bog rush	<i>Juncus stygius</i>		T(MI), E(WI)
Vasey's rush	<i>Juncus vaseyi</i>		T(MI), SC(WI)
False boneset	<i>Kuhnia eupatorioides</i>		SC(MI)
Blue lettuce	<i>Lactuca pulchella</i>		T(MI)
Least pinweed	<i>Lechea minor</i>		SC(MI)
Erect pinweed	<i>Lechea stricta</i>		SC(MI)
White ground cherry	<i>Leucophysalis grandiflora</i>		SC(WI)
Furrowed flax	<i>Linum sulcatum</i>		SC(MI)
Auricled twayblade	<i>Listera auriculata</i>	3C	SC(MI)
Broad-leaved twayblade	<i>Listera convallarioides</i>		T(WI)
Broad-leaved puccoon	<i>Lithospermum latifolium</i>		SC(MI)
American shore-grass	<i>Littorella americana</i>		SC(MI), (WI)
Black twinberry	<i>Lonicera involucrata</i>		T(MI)
Small-flowered woodrush	<i>Luaula parviflora</i>		T(MI)
Clubmoss	<i>Lycopodium appressum</i>		T(MI)
Savin-leaved clubmoss	<i>Lycopodium sabinifolium</i>		E(MI)
Fir clubmoss	<i>Lycopodium selago</i>		SC(MI)
White adder's-mouth	<i>Malaxis brachypoda</i>		SC(WI)
Indian cucumber root	<i>Medeola virginiana</i>		SC(WI)
Virginia bluebells	<i>Mertensia virginica</i>		T(MI)
James' monkey-flower	<i>Mimulus glabratus</i> var. <i>jamesii</i>		SC(MI)
Michigan monkey-flower	<i>Mimulus glaratus</i> var. <i>michiganensis</i>	LE	E(MI)
Western monkey-flower	<i>Mimulus guttatus</i>		SC(MI)
Large-leaved sandwort	<i>Moehringia macrophylla</i>		E(WI)
Plains muhly	<i>Muhlenbergia cuspidata</i>		X(MI)
Mat muhly	<i>Muhlenbergia richardsonis</i>		T(MI)
Alternate-leaved water-milfoil	<i>Myriophyllum alterniflorum</i>		SC(MI)
Farwell's water-milfoil	<i>Myriophyllum farwellii</i>		T(MI), SC(WI)
Small yellow pond-lily	<i>Nuphar pumila</i>		T(MI)
Pygmy water-lily	<i>Nymphaea tetragona</i>		T(MI)
Adder's-tongue	<i>Ophioglossum vulgatum</i>		SC(WI)
Devil's-club	<i>Oplopanax horridus</i>		T(MI)
Fragile prickly-pear	<i>Opuntia fragilis</i>		E(MI)
Fascicled broom-rape	<i>Orobanche fasciculata</i>		T(MI)
Canada rice-grass	<i>Oryzopsis canadensis</i>		T(MI), SC(WI)
Sweet cicely	<i>Osmorhiza depauperata</i>		SC(MI)
Ginseng	<i>Panax quinquefolius</i>	3C	T(MI), SC(WI)
Small-fruited panic-grass	<i>Panicum microcarpon</i>		SC(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 6 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Marsh grass-of-parnassus	<i>Parnassia palustris</i>		T(MI)
Purple cliff-brake	<i>Pellaea atropurpurea</i>		T(MI)
Slender beard-tongue	<i>Penstemon gracilis</i>		E(MI)
Hairy beardtongue	<i>Penstemon hirsutus</i>		SC(WI)
Pale beardtongue	<i>Penstemon pallidus</i>		SC(WI)
Sweet coltsfoot	<i>Petasites sagittatus</i>		T(MI)
Franklin's phacelia	<i>Phacelia franklinii</i>		T(MI)
Broad beech fern	<i>Phegopteris hexagonoptera</i>		SC(WI)
Mountain timothy	<i>Phleum alpinum</i>		X(MI)
Hart's-tongue fern	<i>Phyllitis scolopendrium</i> var. <i>americana</i>	LT	E(MI)
Butterwort	<i>Pinguicula vulgaris</i>		SC(MI)
Alaska orchid	<i>Piperia unalascensis</i>		SC(MI)
Orange or yellow fringed orchid	<i>Platanthera ciliaris</i>		T(MI)
White bog orchid	<i>Platanthera dilatata</i>		SC(WI)
Tubercled orchid	<i>Platanthera flava</i> var. <i>herbiola</i>		T(WI)
Hooker's orchid	<i>Platanthera hookeri</i>		SC(WI)
Prairie fringed orchid	<i>Platanthera leucophaea</i>	LT	E(MI)
Round-leaved orchid	<i>Platanthera orbiculata</i>		SC(WI)
Alpine bluegrass	<i>Poa alpina</i>		T(MI)
Canby's bluegrass	<i>Poa canbyi</i>		T(MI)
Bog bluegrass	<i>Poa paludigena</i>	C2	T(MI)
Western jacob's ladder	<i>Polemonium occidentale</i> <i>lacustre</i>	C	SC(WI)
Cross-leaved milkwort	<i>Polygala cruciata</i>		SC(MI)
Carey's smartweed	<i>Polygonum careyi</i>		T(MI)
Alpine bistort	<i>Polygonum viviparum</i>		T(MI)
Large-flowered leafcup	<i>Polymnia uvedalia</i>		T(MI)
Braun's holly fern	<i>Polystichum braunii</i>		T(WI)
Brown walker	<i>Pomatiopsis cincinnatiensis</i>		SC(MI)
Waterthread pondweed	<i>Potamogeton bicupulatus</i>		T(MI)
Alga pondweed	<i>Potamogeton confervoides</i>	C2	T(MI), (WI)
Hill's pondweed	<i>Potamogeton hillii</i>	3C	T(MI)
Spotted pondweed	<i>Potamogeton pulcher</i>		T(MI), E(WI)
Sheathed pondweed	<i>Potamogeton vaginatus</i>		T(WI)
Vasey's pondweed	<i>Potamogeton vaseyi</i>		SC(WI)
Prairie cinquefoil	<i>Potentilla pensylvanica</i>		T(MI)
Bird's-eye primrose	<i>Primula mistassinica</i>		SC(WI)
Sloe plum	<i>Prunus alleghaniensis</i>	C2	SC(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 7 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Alleghany or sloe plum	<i>Prunus alleghaniensis</i> var. <i>davisii</i>	C2	SC(MI)
Bald-rush	<i>Psilocarya scirpoides</i>		T(MI)
Pine-drops	<i>Pterospora andromedea</i>		T(MI)
Hairy mountain-mint	<i>Pycnanthemum pilosum</i>		SC(MI)
Small shinleaf	<i>Pyrola minor</i>		E(WI)
Seaside crowfoot	<i>Ranunculus cymbalaria</i>		T(MI)
Small yellow water crowfoot	<i>Ranunculus gmelinii</i> var. <i>hookeri</i>		E(WI)
Lapland buttercup	<i>Ranunculus lapponicus</i>		T(MI)
Macoun's buttercup	<i>Ranunculus macounii</i>		T(MI)
Prairie buttercup	<i>Ranunculus rhomboideus</i>		T(MI)
Meadow-beauty	<i>Rhexia virginica</i>		SC(MI)
Sooty beakrush	<i>Rhynchospora fusca</i>		SC(WI)
Tall beak-rush	<i>Rhynchospora macrostachya</i>		SC(MI)
Canadian black currant	<i>Ribes hudsonianum</i>		SC(WI)
Northern gooseberry	<i>Ribes oxycanthoides</i>		SC(MI)
Tooth-cup	<i>Rotala ramosior</i>		SC(MI)
Dwarf raspberry	<i>Rubus acaulis</i>		T(MI)
Showy coneflower	<i>Rudbeckia sullivantii</i>		SC(MI)
Widgeon-grass	<i>Ruppia maritima</i>		T(MI)
Pearlwort	<i>Sagina nodosa</i>		T(MI)
Satiny willow	<i>Salix pellita</i>		SC(MI)
Tea-leaved willow	<i>Salix planifolia</i>		T(MI)
Silky willow	<i>Salix sericea</i>		SC(WI)
Yellow pitcher-plant	<i>Sarracenia purpurea</i> ssp <i>heterophylla</i>		T(MI)
Encrusted saxifrage	<i>Saxifraga paniculata</i>		T(MI)
Prickly saxifrage	<i>Saxifraga tricuspidata</i>		T(MI)
Tussock bulrush	<i>Scirpus cespitosus</i> var. <i>callosus</i>		E(WI)
Clinton's bulrush	<i>Scirpus clintonii</i>		T(MI)
Pale bulrush	<i>Scirpus pallidus</i>		SC(WI)
Torrey's bulrush	<i>Scirpus torreyi</i>		SC(MI)
Small skullcap	<i>Scutellaria parvula</i>		T(MI)
Marsh-fleabane	<i>Senecio congestus</i>		X(MI), SC(WI)
Rayless mountain ragwort	<i>Senecio indecorus</i>		T(MI), SC(WI)
Fire pink	<i>Silene virginica</i>		T(MI)
Compass-plant	<i>Silphium laciniatum</i>		T(MI)
Blue-eyed-grass	<i>Sisyrinchium strictum</i>		SC(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 8 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Reclining goldenrod	<i>Solidago decumbens</i>		SC(MI)
Houghton's goldenrod	<i>Solidago houghtonii</i>	LT	T(MI)
Western goldenrod	<i>Solidago lepida</i>		SC(MI)
Yellow ladies'-tresses	<i>Spiranthes ochroleuca</i>		SC(MI)
Prairie dropseed	<i>Sporobolus heterolepis</i>		T(MI)
Fleshy stitchwort	<i>Stellaria crassifolia</i>		T(MI)
Stitchwort	<i>Stellaria longipes</i>		SC(MI)
Awlwort	<i>Subularia aquatica</i>		T(MI)
Lake Huron tansy	<i>Tanacetum huronense</i>		T(MI)
Waxy meadow-rue	<i>Thalictrum revolutum</i>		T(MI)
Veiny meadow-rue	<i>Thalictrum venulosum varconfine</i>		T(MI)
Foamflower	<i>Tiarella cordifolia</i>		E(WI)
False asphodel	<i>Tofieldia pusilla</i>		T(MI)
Virginia spiderwort	<i>Tradescantia virginiana</i>		SC(MI)
False pennyroyal	<i>Trichostema brachiatum</i>		T(MI)
Common bog arrow-grass	<i>Triglochin maritimum</i>		SC(WI)
Slender bog arrow-grass	<i>Triglochin palustre</i>		SC(WI)
Three-birds orchid	<i>Triphora trianthophora</i>		T(MI)
Downy oat-grass	<i>Trisetum spicatum</i>		SC(MI)
Twin-stemmed bladderwort	<i>Utricularia geminiscapa</i>		SC(WI)
Purple bladderwort	<i>Utricularia purpurea</i>		SC(WI)
Small purple bladderwort	<i>Utricularia resupinata</i>		SC(WI)
Dwarf bilberry	<i>Vaccinium cespitosum</i>		T(MI), E(WI)
Alpine blueberry	<i>Vaccinium uliginosum</i>		T(MI)
Mountain-cranberry	<i>Vaccinium vitis-idaea</i>		X(MI)
Marsh valerian	<i>Valeriana sitchenesis</i> ssp <i>uliginosa</i>		T(WI)
Witthe rod	<i>Viburnum cassinoides</i>		SC(WI)
Squashberry or mooseberry	<i>Viburnum edule</i>		T(MI)
Northern marsh violet	<i>Viola epipsila</i>		T(MI)
New England violet	<i>Viola novae-angliae</i>	C2	T(MI), (WI)
Prairie birdfoot violet	<i>Viola pedatifida</i>		T(MI)
Northern woodsia	<i>Woodsia alpina</i>		T(MI)
Blunt-lobed woodsia	<i>Woodsia obtusa</i>		T(MI)
Wild-rice	<i>Zizania aquatica</i> var. <i>aquatica</i>		T(MI)
Prairie golden alexanders	<i>Zizia aptera</i>		T(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 9 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Animals			
Cooper's hawk	<i>Accipiter cooperii</i>		R(WI)
Lake sturgeon	<i>Acipenser fulvescens</i>	C2	T(MI), R(WI)
Blanchard's cricket frog	<i>Acris crepitans blanchardi</i>		SC(MI)
Mottled darner	<i>Aeshna clepsydra</i>		SC(WI)
Lake darner	<i>Aeshna eremita</i>		SC(WI)
Black-tipped darner	<i>Aeshna tuberculifera</i>		SC(WI)
Elktoe	<i>Alasmodonta marginata</i>		R(WI)
Slippershell	<i>Alasmodonta viridis</i>		T(WI)
Moose	<i>Alces alces</i>		SC(MI)
American eel	<i>Anguilla rostrata</i>		SC(WI)
Pirate perch	<i>Aphredoderus sayanus</i>		SC(WI)
Secretive locust	<i>Appalachia arcana</i>	C2	SC(MI)
Missouri rock cress	<i>Arabis missouriensis</i> var. <i>deamii</i>	C	SC(WI)
Short-eared owl	<i>Asio flammeus</i>		E(MI)
Dusted skipper	<i>Atrytonopsis hianna</i>		T(MI)
Upland sandpiper	<i>Bartramia longicauda</i>		R(WI)
Bog fritillary	<i>Boloria eunomia</i>		SC(WI)
Freija fritillary	<i>Boloria freija</i>		SC(WI)
Frigga fritillary	<i>Boloria frigga</i>		SC(WI)
Boreal brachionyncha	<i>Brachionyncha borealis</i>		SC(MI)
Hungerford's crawling water beetle	<i>Brychius hungerfordi</i>	LE	E(MI)
Red-shouldered hawk	<i>Buteo lineatus</i>		T(MI), T(WI)
Swamp metalmark	<i>Calephelis mutica</i>		T(WI)
Gray wolf	<i>Canis lupus</i>	LELT	E(MI), (WI)
Great egret	<i>Casmerodius albus</i>		T(WI)
Piping plover	<i>Charadrius meoldus</i>	LELT	E(MI), (WI)
Black tern	<i>Chlidonias niger</i>	C	R(WI)
Northern harrier	<i>Circus cyaneus</i>		SC(MI)
Spotted turtle	<i>Clemmys guttata</i>		SC(MI)
Wood turtle	<i>Clemmys insculpta</i>		SC(MI), (WI)
Redside dace	<i>Clinostomus elongatus</i>		SC(WI)
Subarctic bluet	<i>Coenagrion interrogatum</i>		SC(WI)
Inornate ringlet	<i>Coenonympha tullia</i>		SC(WI)
Delta-spotted spiketail	<i>Cordulegaster diastatops</i>		SC(WI)
Arrowhead spiketail	<i>Cordulegaster obliqua</i>		SC(WI)
Lake herring	<i>Coregonus artedii</i>		R(WI)
Siskiwit lake cisco	<i>Coregonus bartlettii</i>		SC(MI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 10 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Bloater	<i>Coregonus hoyi</i>		R(WI)
Ives lake cisco	<i>Coregonus hubbsi</i>		SC(MI)
Yellow rail	<i>Coturnicops noveboracensis</i>		T(MI), R(WI)
Cerulean warbler	<i>Dendroica cerulea</i>	C	T(WI)
Kirtland's warbler	<i>Dendroica kirtlandii</i>	LE	E(MI)
Snuffbox mussel	<i>Dysnomia triquetra</i>	C2	E(MI)
Eastern fox snake	<i>Elaphe vulpina gloydi</i>		T(MI)
Atlantic elliptio	<i>Elliptio complanata</i>		R(WI)
Blanding's turtle	<i>Emydoidea blandingii</i>	C	T(WI)
Snuffbox mussel	<i>Epioblasma triquetra</i>	C	E(WI)
Red-disked alpine	<i>Erebia discoidalis</i>		SC(MI), (WI)
Lake chubsucker	<i>Erimyzon sucetta</i>		SC(WI)
Early hairstreak	<i>Erora laeta</i>		SC(MI)
Persius dusky wing	<i>Erynnis persius persius</i>		SC(WI)
Least darter	<i>Etheostoma microperca</i>		SC(WI)
Banded darter	<i>Etheostoma zonale</i>		SC(MI)
Dion skipper	<i>Euphyes dion</i>		SC(WI)
Merlin	<i>Falco columbarius</i>		T(MI)
Peregrine falcon	<i>Falco peregrinus</i>	E/SA	E(MI)
American peregrine falcon	<i>Falco peregrinus anatum</i>	E	E(WI)
Lynx	<i>Felis lynx</i>	C2	E(MI)
Harvester	<i>Feniseca tarquinius</i>		SC(WI)
Watercress snail	<i>Fontigens nickliniana</i>		SC(MI)
Common moorhen	<i>Gallinula chloropus</i>		SC(MI)
Common loon	<i>Gavia immer</i>		T(MI)
White-lined clubtail	<i>Gomphus lineatifrons</i>		SC(MI), (WI)
Four-colored clubtail	<i>Gomphus quadricolor</i>		SC(MI), (WI)
Midland clubtail	<i>Gomphurus fraternus</i>		SC(WI)
Skillet clubtail	<i>Gomphurus ventricosus</i>		SC(WI)
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	T(MI), (WI)
Cherrystone drop	<i>Hendersonia occulta</i>		T(MI)
Ottoe skipper	<i>Hesperia ottoe</i>		T(MI)
Green-faced clubtail	<i>Hylogomphus viridifrons</i>		SC(WI)
Henry's elfin	<i>Incisalia henrici</i>		SC(MI)
Frosted elfin	<i>Incisalia irus</i>		T(MI)
Citrine forktail	<i>Ischnura hastata</i>		SC(WI)
Loggerhead shrike	<i>Lanius ludovicianus</i>	C	E(WI)
Loggerhead shrike	<i>Lanius ludovicianus migrans</i>	C2	E(MI)
Great Plains spittlebug	<i>Lepyronia gibbosa</i>		T(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 11 of 13

Common Name	Scientific Name	Status	
		Federal	State
Amber-winged spreadwing	<i>Lestes eurinus</i>		SC(WI)
Swamp spreadwing	<i>Lestes vigilax</i>		SC(WI)
Longear sunfish	<i>Lepomis megalotis</i>		T(WI)
Slaty skimmer	<i>Libellula incesta</i>		SC(WI)
Northern blue butterfly	<i>Lycaeides idas nabokovi</i>		T(MI), E(WI)
Karner blue butterfly	<i>Lycaeides melissa samuelis</i>	LE	T(MI), SC(WI)
Dorcas copper	<i>Lycaena dorcas</i>		SC(WI)
Bog copper	<i>Lycaena epixanthe</i>		SC(WI)
Lynx	<i>Lynx canadensis</i>	C	E(WI)
Redfin shiner	<i>Lythrurus umbratilis</i>		T(WI)
Pine marten	<i>Martes americana</i>		T(MI), E(WI)
Doll's merolonche	<i>Merolonche dolli</i>		SC(MI)
Spike-lipped crater	<i>Mesodon sayanus</i>		SC(MI)
Woodland vole	<i>Microtus pinetorum</i>		SC(MI)
River redhorse	<i>Moxostoma carinatum</i>		T(MI), (WI)
Greater redhorse	<i>Moxostoma valenciennesi</i>		T(WI)
Elfin skimmer	<i>Nannothemis bella</i>		SC(WI)
Cyrano darner	<i>Nasiaeschna pentacantha</i>		SC(WI)
Stygian shadowfly	<i>Neurocordulia yamaskanensis</i>		SC(WI)
American burying beetle	<i>Nicrophorus americanus</i>	LE	E(MI), (WI)
Pugnose shiner	<i>Notropis anogenus</i>		SC(MI), T(WI)
Weed shiner	<i>Notropis texanus</i>		E(MI), SC(WI)
Slender madtom	<i>Noturus exilis</i>		E(WI)
Black-crowned night-heron	<i>Nycticorax nycticorax</i>		SC(MI), R(WI)
Jutta arctic	<i>Oeneis jutta ascerta</i>		SC(WI)
3-striped oncocnemis	<i>Oncocnemis piffardi</i>		SC(MI)
Extra-striped snaketail	<i>Ophiogomphus anomalus</i>	C	E(WI)
Riffle snaketail	<i>Ophiogomphus carolus</i>		SC(WI)
Pygmy snaketail	<i>Ophiogomphus howei</i>	C	E(WI)
Pugnose minnow	<i>Opsopoeodus emiliae</i>		SC(WI)
Three-horned moth	<i>Pachypolia atricornis</i>		SC(MI)
Osprey	<i>Pandion haliaetus</i>		T(MI), (WI)
Aweme borer	<i>Papaipema aweme</i>	C2	SC(MI)
Blazing star borer	<i>Papaipema beeriana</i>		SC(MI)
Culvers root borer	<i>Papaipema sciata</i>		SC(MI)
Channel darter	<i>Percina copelandi</i>		T(MI)
River darter	<i>Percina shumardi</i>		E(MI)
Double-crested cormorant	<i>Phalacrocorax auritus</i>		R(WI)
Tawny crescent spot	<i>Phyciodes batesii</i>	C	SC(WI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 12 of 13**

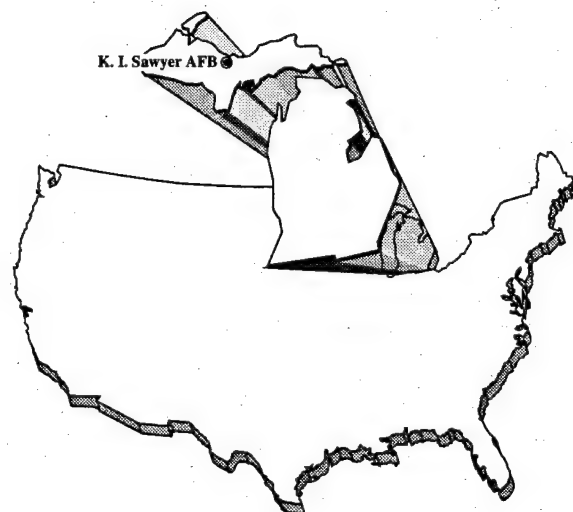
Common Name	Scientific Name	Status	
		Federal	State
Black-backed woodpecker	<i>Picoides arcticus</i>		SC(MI)
West Virginia white	<i>Pieris virginiensis</i>		SC(WI)
Eastern flat-whorl	<i>Planogyra asteriscus</i>		SC(MI)
Acorn rams-horn	<i>Planorbella multivolvis</i>	C2	E(MI)
Round pigtoe	<i>Pleurobema sintoxia</i>		R(WI)
Mulberry wing	<i>Poanes massasoit</i>		SC(WI)
Broad-winged skipper	<i>Poanes viator</i>		SC(WI)
Red-necked grebe	<i>Podiceps grisegena</i>		E(WI)
Paddlefish	<i>Polyodon spathula</i>	C	T(WI)
Red-legged spittlebug	<i>Prosapia ignipectus</i>		SC(MI)
	<i>Prunus alleghaniensis</i>	3C	
Boreal chorus frog	<i>Pseudacris triseriata maculata</i>		SC(MI)
Sprague's pygarcia	<i>Pygarcia spraguei</i>		SC(MI)
Grizzled skipper	<i>Pyrgus wyandot</i>	C2	SC(MI)
King rail	<i>Rallus elegans</i>		E(MI), R(WI)
Pickerel frog	<i>Rana palustris</i>		SC(WI)
Smokey eyed brown	<i>Satyrodes eurydice fumosa</i>		SC(WI)
Phlox moth	<i>Schinia indiana</i>	C2	E(MI), (WI)
Salamander mussel	<i>Simpsoniconcha ambigua</i>	C2	E(MI), T(WI)
Massasauga	<i>Sistrurus catenatus catenatus</i>	C2	SC(MI)
Ski-tailed emerald	<i>Somatochlora elongata</i>		SC(WI)
Forcinate emerald	<i>Somatochlora forcipata</i>		SC(WI)
Delicate emerald	<i>Somatochlora franklini</i>		SC(WI)
Warpaint emerald	<i>Somatochlora incurvata</i>		SC(MI)
Kennedy's emerald	<i>Somatochlora kennedyi</i>		SC(WI)
Smokey shrew	<i>Sorex fumeus</i>		SC(MI)
Spartina moth	<i>Spartiniphaga inops</i>		SC(MI)
Regal fritillary	<i>Speyeria idalia</i>	C2	E(MI)
Deepwater pondsnail	<i>Stagnicola contractus</i>		T(MI)
Douglas stenelmis riffle beetle	<i>Stenelmis douglasensis</i>	C2	SC(MI)
Caspian tern	<i>Sterna caspia</i>		T(MI)
Forster's tern	<i>Sterna forsteri</i>		SC(MI), E(WI)
Common tern	<i>Sterna hirundo</i>	C2NL, T	T(MI), E(WI)
Least clubtail	<i>Stylogomphus albistylus</i>		SC(WI)
Amnicola snaketail	<i>Stylurus amnicola</i>		SC(MI)
Zebra clubtail	<i>Stylurus scudderi</i>		SC(WI)
Black meadowhawk	<i>Sympetrum danae</i>		SC(WI)
Eastern box turtle	<i>Terrapene carolina carolina</i>		SC(MI)
Western ribbon snake	<i>Thamnophis proximus</i>		E(WI)

**Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber
Procurement Area
Page 13 of 13**

Common Name	Scientific Name	Status	
		Federal	State
Northern ribbon snake	<i>Thamnophis sauritus</i>		E(WI)
Lake Huron locust	<i>Trimerotropis huroniana</i>	C2	T(MI)
Buckhorn	<i>Tritogonia verrucosa</i>		T(WI)
Greater prairie-chicken	<i>Tympanuchus cupido</i>		T(WI)
Barn owl	<i>Tyto alba</i>		E(WI)
Canadian bog skimmer	<i>Williamsonia fletcheri</i>		SC(MI)
Ebony bog haunter	<i>Williamsonia fletcheri</i>		SC(WI)
Yellow-headed blackbird	<i>Xanthocephalus</i> <i>xanthocephalus</i>		SC(MI)

C	=	Candidate for federal listing
C2	=	Endangered or threatened status may be more appropriate, but more information is needed
C2NL,T	=	Threatened in part of its range, C2 in part of its range, not listed in the rest of its range
E	=	Endangered
E/SA	=	Endangered; eastern subspecies, which is similar in appearance, is also listed as endangered
LE	=	Endangered in part of its range
LELT	=	Endangered in part of its range and threatened in the rest of its range
LT	=	Threatened in part of its range
MI	=	Michigan
R	=	Rare
SC	=	Special Concern (rare, may become endangered or threatened in the future)
T	=	Threatened
3C	=	Not currently being considered for listing
WI	=	Wisconsin
X	=	Probably extirpated

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APPENDIX L

APPENDIX L
FARMLAND CONVERSION IMPACT RATING
FORM AD-1006



United States
Department of
Agriculture

Soil
Conservation
Service

May 28, 1994

Ted Shierk
HQ AFCEE/EC
8106 Chennault Road
Brooks AFB, TX 78235-5318

Dear Mr. Shierk,

The four alternatives being analyzed at K.I. Sawyer AFB, MI will not affect prime, unique, statewide, or local important farmland.

Sincerely,

Michael J. LaPointe, District Conservationist
Ph: 908-226-9460



The Soil Conservation Service
is an agency of the
Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I (To be completed by Federal Agency)		Date Of Land Evaluation Request 03 May 1994	
Name Of Project K. I. Sawyer AFB Disposal and Reuse		Federal Agency Involved USAF, FAA	
Proposed Land Use Airfield Aviation, Mixed Use		County And State Marquette, Michigan	
PART II (To be completed by SCS)		Date Request Received By SCS	
Does the site contain prime, unique, statewide or local important farmland? (If no, the FPPA does not apply — do not complete additional parts of this form).		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Acres Irrigated	Average Farm Size
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Amount Of Farmland As Defined in FPPA Acres: %	
		Date Land Evaluation Returned By SCS	
PART III (To be completed by Federal Agency)		Alternative Site Rating	
		Site A	Site B
		Site C	Site D
A. Total Acres To Be Converted Directly *		3,828	3,122
B. Total Acres To Be Converted Indirectly		0	0
C. Total Acres In Site		4,923	4,923
PART IV (To be completed by SCS) Land Evaluation Information			
A. Total Acres Prime And Unique Farmland			
B. Total Acres Statewide And Local Important Farmland			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value			
PART V (To be completed by SCS) Land Evaluation Criterion			
Relative Value Of Farmland To Be Converted (Scale of 0 to 100 Points)			
PART VI (To be completed by Federal Agency)			
Site Assessment Criteria (These criteria are explained in 7 CFR 658.5(b))	Maximum Points		
1. Area In Nonurban Use			
2. Perimeter In Nonurban Use			
3. Percent Of Site Being Farmed			
4. Protection Provided By State And Local Government			
5. Distance From Urban Builtup Area			
6. Distance To Urban Support Services			
7. Size Of Present Farm Unit Compared To Average			
8. Creation Of Nonfarmable Farmland			
9. Availability Of Farm Support Services			
10. On-Farm Investments			
11. Effects Of Conversion On Farm Support Services			
12. Compatibility With Existing Agricultural Use			
TOTAL SITE ASSESSMENT POINTS	160		
PART VII (To be completed by Federal Agency)			
Relative Value Of Farmland (From Part V)	100		
Total Site Assessment (From Part VI above or a local site assessment)	160		
TOTAL POINTS (Total of above 2 lines)	260		
Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Reason For Selection:			

* Not available for agriculture

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 — Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 — Originator will send copies A, B and C together with maps indicating locations of site(s), to the Soil Conservation Service (SCS) local field office and retain copy D for their files. (Note: SCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the SCS State Conservationist in each state).

Step 3 — SCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

Step 4 — In cases where farmland covered by the FPPA will be converted by the proposed project, SCS field offices will complete Parts II, IV and V of the form.

Step 5 — SCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for SCS records).

Step 6 — The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 — The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in §658.5(b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total weight points at 160.

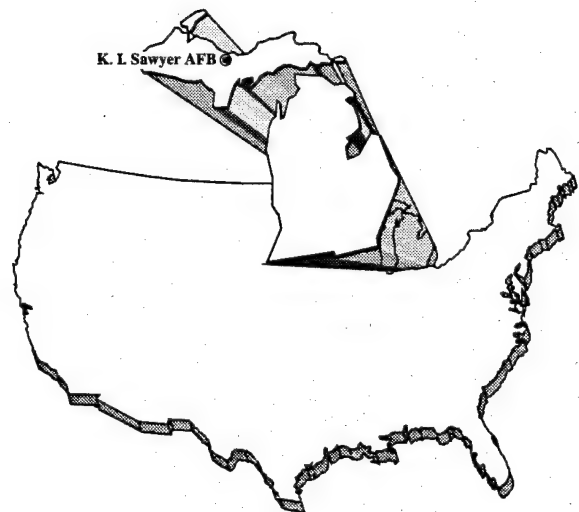
In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points", where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points; and alternative Site "A" is rated 180 points:

Total points assigned Site A = 180 x 160 = 144 points for Site "A."

Maximum points possible 200

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APPENDIX M

APPENDIX M
AGENCY LETTERS AND CERTIFICATIONS



Bureau of Michigan History, State Historic Preservation Office
Michigan Library and Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

November 29, 1993

GARY P BAUMGARTEL
LT COL
DEPARTMENT OF THE AIRFORCE
CENTER FOR ENVIRONMENTAL EXCELLENCE
8106 CHENNAULT ROAD
BROOKS AIRFORCE BASE TX 78235-5318

RE: ER-940088 Disposal and reuse of K. I. Sawyer Air Force Base, Marquette County
(USAF)

Dear Lt. Col. Baumgartel:

We have received your request for review of the above-cited project. Unfortunately, because we lack sufficient survey data for the project area, we are unable to determine the historic significance of above-ground resources that may be affected by this project. We request that buildings and structures on the base be inventoried by qualified (36 CFR Part 61) professionals. This information will allow us to determine if National Register-eligible properties exist within the project area, and what, if any, effect this project may have on them.

A Bureau of Michigan History inventory card should be prepared for each structure that may be affected by project activities. Each card should contain an original photograph, the street address, and a locational map. Research utilizing such source materials as historic maps, published and unpublished sources, government records, and oral interviews should be performed. A report should then be prepared that sets forth the basic facts in the historical development of the structures in the base. The report should deal with the historical significance of these properties individually, and in the context of the surrounding community as a whole. It should contain recommendations concerning buildings and areas that appear to meet the National Register criteria and a rationale for each determination.

M-1

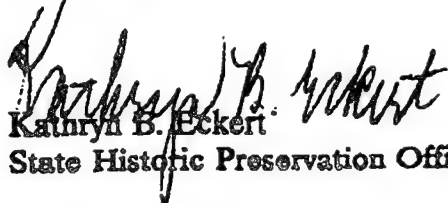


Bureau of History
Michigan Historic Preservation Office

Page 2

Please note that the Section 106 review process cannot proceed until we are able to consider the information requested above. If you have any questions, please contact the Environmental Review Coordinator at (517) 335-2721.

Sincerely,



Kathryn B. Eckert
State Historic Preservation Officer

KBE:JRH:ROC:em



United States Department of the Interior

BUREAU OF MINES
Intramountain Field Operations Center
P.O. Box 25086
Building 20, Denver Federal Center
Denver, Colorado 80226

December 02, 1993

Lt Co. Gary P. Baumgartel
AFCEE/ESE, 8106 Chennault Road
Brooks AFB TX 78235-5318

Dear Lt Co. Baumgartel:

Subject: Notice of Intent to Prepare an Environmental Impact
Statement for Disposal and Reuse of Seven Air Force Bases
(ER 93/903)

Personnel of the Bureau of Mines, reviewed the Notice of Intent (NOI) for possible conflict with mineral resources and mineral-producing facilities, as requested by the Director, Office of Environmental Affairs, Department of the Interior. In some instances various mineral resources are situated on or near the Air Force base being considered for disposal.

Preliminary review of available data suggests that the mineral resources included below should be considered during preparation of the various environmental documents.

Gentile AFB Station - Dayton, Montgomery County, Ohio:

Nine sand and gravel pits and four limestone quarries are active in the county. According to state records, about 2.5 million tons of construction aggregates were produced in the county in 1992. Base closure is not expected to significantly affect area mineral resources.

Griffiss AFB - Rome, Oneida County, New York:

At least 12 companies are currently producing construction sand and gravel from 16 pits in Oneida County. At least three of these operations are near the town of Rome. Beazer USA/Hanson is mining crushed limestone southeast of Griffiss in the vicinity of the town of Oriskany. Industrial sand is produced 15 miles west of Rome near the town of McConnellsville. Area mineral resources are not expected to be significantly affected by base closure.

March AFB - Riverside, Riverside County, California:

The area is underlain by sand and gravel. USGS topographic maps of the area show at least five gravel pits and one quarry near the western side of the base. Two pipelines on the north side of the base also are shown on area USGS topographic maps. Area mineral resources and pipeline operations probably would not be significantly impacted by base closure.

Newark AFB - Newark, Licking County, Ohio:

Four sand & gravel pits, one salt brine operation, and one clay operation are active in the county. One sand and gravel pit and the salt operation are near Newark. No significant impact to mineral resources is expected with base closure.

K. I. Sawyer AFB - Marquette, Marquette County, Michigan:

The area of the base is covered by glacially derived material. Four sand and gravel pits, near the western side of the base, are shown on USGS topographic maps of the area. Sand and gravel, mined in the vicinity of the base, probably was used as fill material for base construction. Significant impacts to mineral resources in the area are not expected with base closure.

O'Hare International Airport AF Reserve Station - Chicago, Illinois:

Deposits of clay, limestone/dolomite, and sand and gravel have been mined in the Chicago area. USGS topographic maps of the area show at least one clay pit on the eastern side of the O'Hare International Airport complex, a quarry is shown four miles to the south in the community of Elmhurst, and a large pit area (possible quarry) is about four miles to the north in the Northfield area. Again, no impact is expected to mineral resources with base closure.

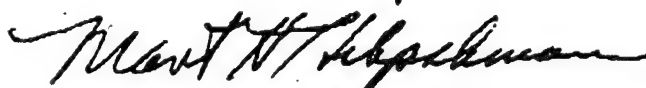
Plattsburg AFB - Plattsburg, Clinton County, New York:

Construction sand and gravel is mined by four companies operating six pits in Clinton County. At least four of the operations are in the vicinity of the town of Plattsburg. Plattsburg Quarries Inc. currently mines crushed limestone near Plattsburg. Most of the crushed stone is used for concrete and bituminous aggregate and roadbase. Base closure is not expected to significantly affect mineral resources in the area.

A discussion should be included in the planned Environmental Impact Statement stating whether these or any other mineral resources are present on the affected bases and how they would be affected by disposal and reuse. If no adverse impacts to mineral resources are identified, a statement to that effect should be included.

We appreciate this opportunity to provide comments on the proposed project. Our comments are drawn from available information, are provided on a technical assistance basis only, and may not reflect the position of the Department of the Interior.

If you have questions regarding this review, please contact Robert Wood at (303) 236-0451.

A handwritten signature in dark ink, appearing to read "Mark H. Hibbsman". The signature is fluid and cursive, with the first name "Mark" being the most prominent.

Mark H. Hibbsman
Supervisory Physical Scientist



IN REPLY REFER TO:

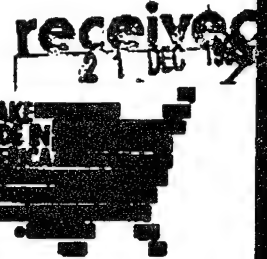
FWS/AES-DHC

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

DEC 16 1993

ESE WAB
ESE-D _____



Lt. Colonel Gary P. Baumgartel
Chief, Environmental Planning Division
HQ AFCEE/ESE
8106 Chennault Road
Brooks Air Force Base, Texas 78235-5318

Dear Colonel Baumgartel:

Appropriate field offices within Region 3 of the U.S. Fish and Wildlife Service (Service) have reviewed the Air Force's Notice of Intent to Prepare Environmental Impact Statements for Disposal and Reuse of Seven Air Force Bases, as announced in the Federal Register of October 28, 1993. The Chicago, Illinois, Field Office, and Reynoldsburg, Ohio, Field Office provided responses of "No Comment" regarding the proposed disposal and reuse of O'Hare International Airport Air Force Reserve Station, Gentile Air Force Station, and Newark Air Force Base. The comments of the East Lansing, Michigan, Field Office are provided below:

K. I. Sawyer Air Force Base

A search of the Service's endangered species database has revealed no known occurrences of Federal listed, proposed or candidate species on K. I. Sawyer Air Force Base. However, the data presently available are not definitive for the absence of listed species, particularly for plants and invertebrates. Therefore, surveys for listed and candidate plants and invertebrates whose ranges include the area of the air base are recommended. Please contact the East Lansing, Michigan, Field Office for a list of such species and for information concerning characteristics of habitats supporting the species. The results of the recommended surveys should be disclosed in the draft statement.

The draft statement should also address potential impacts of proposed base disposal and reuse on the bald eagle (Haliaeetus leucocephalus), eastern timber wolf (Canis lupus), and Kirtland's warbler (Dendroica kirtlandii). The eagle and wolf are wide ranging species found in the vicinity of K. I. Sawyer Air Force Base. Kirtland's warbler should be included due to the presence of jack pine forest habitat on this installation, and the recent occurrence of male Kirtland's warblers nearby in Marquette County.

We also recommend that the following two Michigan Department of Natural Resources representatives be contacted regarding State of Michigan listed threatened and endangered species, sensitive habitats, and more detailed wildlife locale information:

Mr. Tom Weise
Endangered Species Coordinator
Michigan Department of Natural Resources
Steven T. Mason Building
P. O. Box 30028
Lansing, Michigan 48909

Mr. John Hendrickson
Regional Wildlife Supervisor
Michigan Department of Natural Resources
Region 1 Headquarters
1990 US-41 South
Marquette, Michigan 49855

National Wetlands Inventory maps indicate the presence of wetland habitats on K. I. Sawyer Air Force Base, including some drainages associated with the East Branch Escanaba River. Potential wetlands impacts and long-term protection provisions should be addressed in the draft statement, including compliance with Executive Order 11990 (Protection of Wetlands).

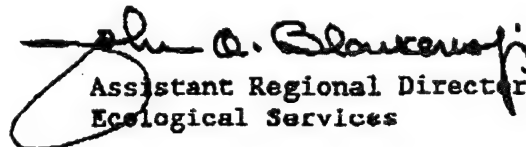
Environmental contamination should also be evaluated with respect to base disposal and reuse options. The draft statement should include a comprehensive survey of potential contaminated sites and planned remedial action, if any is warranted.

For further technical assistance, please contact Mr. Charles Wooley, Field Supervisor, Ecological Services Field Office, U. S. Fish and Wildlife Service, 1405 South Harrison Rd. - Room 302, East Lansing, Michigan 48823 -- Telephone: (517) 337-6650.

The opportunity for the Service to provide our fish and wildlife resource protection recommendations is appreciated.

Questions pertaining to these comments can be directed to Mr. Lynwood MacLean of my staff by calling (612) 725-3538.

Sincerely yours,


Assistant Regional Director
Ecological Services



JOHN ENGLER, Governor

DEPARTMENT OF NATURAL RESOURCES

Stevens T. Mason Building, P.O. Box 30028, Lansing, MI 48909

ROLAND HARMES, Director

NATURAL RESOURCES
COMMISSIONJERRY C. BARTNIK
LARRY DEVUYST
PAUL EISELE
JAMES P. HILL
DAVID HOLLI
JOEY M. SPANO
JORDAN B. TATTER

December 21, 1993

Mr. Gary P. Baumgartel
Department of the Air Force
HQ AFCEE/ESE
8106 Chennauet Road
Brooks AFB, TX 78235-5318

Dear Mr. Baumgartel:

Your request for information was checked against known localities for special natural features recorded in the Michigan Natural Features Inventory (MNFI) database, which is part of the Natural Heritage Program, Wildlife Division. The MNFI is an ongoing, continuously updated information base, which is the only comprehensive single source of existing data on Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features.

However, this database is not yet complete for all areas of the state, since some areas have not been significantly or thoroughly surveyed for natural features. Further, populations of plants and animals, and natural communities are constantly changing. Therefore, absence of known records in the MNFI database should not be taken as a definitive statement on lack of occurrence of special features at a site. In some cases, the only way to obtain a definitive statement on the status of natural features is to have a competent biologist perform a complete field survey.

The presence of listed species does not necessarily preclude development but may require alterations in the development plan. An endangered species permit will be required from the Department of Natural Resources, Wildlife Division, if any listed species would be taken or harmed.

If the project is located on or adjacent to wetlands, inland lakes, or streams, additional permits may be required. Contact the Michigan Department of Natural Resources, Land and Water Management Division, P.O. Box 30028, Lansing, MI 48909 (517-373-1170).

The following is a list of species that are located within the vicinity of the KI Sawyer Air Force Base:

Common Loon (*Gavia immer*) SC
Kirtland's warbler (*Dendroica kirtlandii*) E
narrow-leafed gentian (*Gentiana linearis*) T

As you have requested, there are two gentleman within the Wildlife Division of the Michigan Department of Natural Resources that are knowledgeable about the biota in the area: John Hendrickson at the Marquette Office and John Stuht in Escanaba.

Thank you for your advance coordination in addressing the protection of Michigan's Natural Resource Heritage. If you have further questions, please call me at 517-373-1263.

Sincerely,

Thomas F. Weise
Endangered Species Coordinator
Wildlife Division

M-8

TFW:cjm



U.S. Department
of Transportation
Federal Aviation
Administration

Received
JAN 1994

Airports District Office
Willow Run Airport, East
8820 Beck Road
Belleville, MI 48111

January 12, 1994

Mr. Bruce R. Leighton, P.E.
Technical Assistant
Environmental Planning Division
Department of the Air Force
HQ AFCEE/ESE
8106 Chennault Road
Brooks AFB, TX 78235-5318

Dear Mr. Leighton:

K. I. Sawyer AFB, Oscoda, Michigan
Conversion and Reuse of Environmental Impact Statement (EIS)

We are in receipt of your December 9, 1993, letter and agree that the Federal Aviation Administration (FAA) should be a cooperating agency as long as there appears to be a possible aviation related reuse alternative. The FAA will review and comment on the feasibility of the aviation alternatives and their related environmental impact.

If you have any questions, please contact me at 313-487-7280.

Sincerely,

Ernest P. Gubry
Community Planner

cc:
AGL-611.1



Bureau of Michigan History, State Historic Preservation Office
Michigan Library and Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

April 29, 1994

WILLIAM A MYERS AICP
CHIEF CONSERVATION & PLANNING DIVISION
ENVIRONMENTAL CONSERVATION & PLANNING DIRECTORATE
HQ AFCEE/EC
8106 CHENNAULT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 Proposed disposal of KI Sawyer Air Force Base, Marquette County
(USAF)

Dear Mr. Myers:

We have received your March 3, 1994, letter and archaeological work plan. While the Michigan SHPO did not request an archaeological study of the K.I. Sawyer Base, we encourage the Air Force in its plans to conduct such a study in order to determine the presence or absence of archaeological sites and complete the requirements of the Section 106 process. The Office of the State Archaeologist has reviewed the work plan and it is their opinion that the plan presents a reasonable and adequate strategy for the archaeological survey of the base.

In addition, we are still concerned with the above-ground buildings and structures on the base. We wish to reiterate our request for a survey with recommendations of national register eligibility expressed in our letter of November 29, 1993.

If you have any questions, please contact the Environmental Review Coordinator at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

Kathryn B. Eckert
State Historic Preservation Officer

KBE:KMW:DLA:kw

cc: The Earth Technology Corporation

M-10



Bureau of Michigan History, State Historic Preservation Office
Michigan Library and Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

October 14, 1994

WILLIAM A MYERS, AICP
CHIEF CONSERVATION & PLANNING DIVISION
ENVIRONMENTAL CONSERVATION & PLANNING DIRECTORATE
HQ AFCEE/EC
8106 CHENNAULT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 K.I. Sawyer Air Force Base: Phase I archaeological survey report;
Phase II archaeological evaluation research design; Marquette
County

Dear Mr. Myers:

We have reviewed the two documents produced by Commonwealth Cultural Resources Group (CCRG) entitled "Phase I Archaeological Survey" and "Research Design: Phase II Archaeological Evaluation." We agree that sites 20MQ88 and 20MQ92 are not eligible for listing in the National Register of Historic Places. Further, we also concur with CCRG's recommendation that Phase II investigations be conducted at sites 20MQ89, 20MQ90, 20MQ91, 20MQ93, and 20MQ94.

In general, we are in agreement with the research specifications proposed for the Phase II investigations. We would, however, like to make the following comments. CCRG interprets 20MQ93 as a charcoal kiln complex which includes the remains of one kiln, an area that may have been in preparation for a second kiln, and a storage facility. Forty-eight shovel tests at 20MQ93 produced only 17 artifacts, all bottle glass. The small number of artifacts is not unexpected for a site of this type. We agree with the functional interpretation of the site based on the existing evidence.

CCRG interprets site 20MQ94 as the probable location of a prepared site for a proposed charcoal kiln that was never constructed. We agree that the area defined by the rock facing may indeed be a proposed kiln site. CCRG excavated forty-nine shovel tests at this site. In contrast to the results at 20MQ93, the shovel tests at 20MQ94 produced 355 artifacts. This assemblage is made up of domestic artifacts and structural debris. In particular, there is a strong concentration of positive shovel tests in the clearing on top of the knoll immediately south of the rock facing. In both the Phase I report and in the Phase II research design, 20MQ94 is interpreted as a component of a small industrial complex which is made up of the two sites: 20MQ93 and 94. We do not disagree with this possibility. However, both documents imply that the significance of 20MQ94 is as a

proposed kiln site. We feel that the primary function of the site, and consequently, the primary significance of the site, is an issue that is not yet clear. The size and content of the artifact assemblage from 20MQ94, especially in comparison with that from site 20MQ93, suggests that there may have been a domestic structure on the knoll. It appears to us that there is the potential for 20MQ93 and 20MQ94 to be very different types of sites. This may be an important factor in developing the field testing strategy at the two sites. For example, the prospects for recovering a substantial artifact sample at 20MQ93 appear dim. But, the site has the potential to provide important structural data on the features present, especially the kiln. At 20MQ94, the possibility that there was a structure on the knoll needs to be explored. As part of the testing strategy, this may require trenching designed to locate any structure foundations that may exist.

In addition, we think that observations made in the Phase II research design document on page 2-2 regarding the proximity of the two sites to the Chicago and Northwestern railroad line are important. We would like to see a map illustrating the spatial relationships described in that paragraph included in the report on the Phase II investigations. This map would need to be based in part on the 1939 air photo and should include sites 20MQ93 and 20MQ94, the farm to the north, Sands Station, the railroad tracks, and the two-track road that runs from the sites to Sands Station.

If you have any questions, please contact the Environmental Review Coordinator at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

Kathryn B. Eckert
State Historic Preservation Officer

KBE:DLA:kmw



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Green Bay ES Field Office
1015 Challenger Court
Green Bay, Wisconsin 54311-8331



August 17, 1995

Thomas H. Gross, Colonel, U.S.A.F.
Director, Environmental Conservation and Planning
HQ AFCEE/EC
8106 Chennault Road
Brooks AFB, Texas 78235-5318

Re: Disposal and Reuse of K.I. Sawyer
Air Force Base
Sawmill Timber Procurement Area in
Northeast, Wisconsin

Dear Colonel Gross:

The U.S. Fish and Wildlife Service has received your letter dated June 23, 1995, requesting comments on the subject project. Due to staff time constraints and priority work activities, we are able to only review your project for potential impacts to federally-listed threatened and endangered species or those proposed for listing. Be advised that other environmental concerns may be associated with this project such as wetland and stream impacts, erosion control needs, and effects on state-listed threatened or endangered species. State or federal permits may be needed, as well, if stream or wetland impacts will occur. If resource impacts are expected to occur, we recommend that you forward this project to the appropriate Wisconsin Department of Natural Resources office for their review.

Please provide us copies of any future review documents that may be associated with this project or of future projects you may be planning that would require Service review. This will allow us to keep our files current. We will provide comments as time and work priorities allow.

Federally-Listed Threatened and Endangered Species

A review of information in our files indicates that the following federally-listed threatened or endangered species occur in Marinette, Florence, Forest, Oconto, Shawano, Menominee, Langlade, Lincoln, Oneida, Vilas, Iron, Price and Taylor Counties:

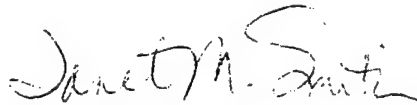
<u>Classification</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Habitat</u>
threatened	bald eagle	<u>Haliaeetus leucocephalus</u>	breeding and wintering
endangered	gray wolf	<u>Canis lupus</u>	northern forested areas
endangered	Karner blue butterfly	<u>Lycaeides melissa samuelis</u>	prairie, oak savanna, and jack pine areas w/wild lupine

There are numerous bald eagle nests and wintering sites, and gray wolves are present in the counties in Wisconsin proposed to procure timber for the alternatives to reuse and develop a sawmill on K.I. Sawyer Air Force Base. Further, there are a few sites in Oconto, Shawano, and Menominee counties in Wisconsin where Karner blue butterflies are present. All three of these species may be impacted by timber harvesting in Wisconsin. The information

you provided in your June 23, 1995 letter is not site-specific enough for us to determine potential impacts to these federally-listed endangered and threatened species. When you develop more site-specific information, please reinitiate consultation with our office so that we may evaluate proposed project impacts on these species in accordance with the Endangered Species Act of 1973, as amended. Further, the U.S. Air Force should make a determination as to whether the proposed project may affect federal endangered and threatened species and advise this office. If it is determined that the project may adversely affect listed species, initiation of the formal consultation process should be requested.

If we can be of further assistance, please contact Mr. Ronald Spry of my staff at 414-433-3803.

Sincerely,

A handwritten signature in cursive script, appearing to read "Janet M. Smith".

Janet M. Smith
Field Supervisor

cc: FWS, ELFO, East Lansing, Michigan



MICHIGAN DEPARTMENT OF STATE

Candice S. Miller, Secretary of State

Lansing, Michigan 48918-0001

received
73 SEP 1995

STATE HISTORIC PRESERVATION OFFICE

Michigan Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

August 24, 1995

MR BRUCE R LEIGHTON PE
TECHNICAL ASSISTANT
ENVIRONMENTAL CONSERVATION & PLANNING DIRECTORATE
DEPT OF THE AIR FORCE
HQ AFCEE/EC
8106 CHENNUALT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 Disposal and reuse, K.I. Sawyer Air Force Base (USAF)

Dear Mr. Leighton:

We have reviewed the report prepared by Commonwealth Cultural Resources Group (CCRG) and Earth Tech entitled "Final Phase II Archaeological Investigation, April 1995: K.I. Sawyer Air Force Base, Marquette County, Michigan."

CCRG performed Phase II evaluation of three precontact Native American sites (20MQ89, 20MQ90 and 20MQ91) and two late nineteenth-early twentieth century Euroamerican sites (20MQ93 and 20MQ94). CCRG recommends that two of the precontact sites, 20MQ90 and 20MQ91, appear to be eligible for listing in the National Register of Historic Places. They recommend that the other three sites do not appear to be eligible.

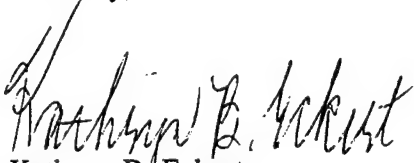
We agree that sites 20MQ90 and 20MQ91 appear to be eligible for listing in the national register. Both sites produced intact, subsurface features containing organic material which allowed radiocarbon dates to be obtained. These sites hold the potential to provide information, including subsistence data, about small, seasonally occupied interior campsites. In addition, it is our opinion that the other sites (20MQ89, 20MQ93 and 20MQ94) do not appear to be eligible for listing in the national register.

The rules and regulations for implementing the provisions of section 106 of the National Historic Preservation Act state that transfer, sale, or lease of an historic property constitutes an adverse effect on the property (36 CFR 800.9[b]). However, transfer, sale or lease of an historic property may be considered to have no adverse effect if "adequate restrictions or conditions are included to ensure preservation of the property's significant historic features" (36 CFR 800.9[c]). Consequently, disposal of K.I. Sawyer Air Force Base would have no adverse effect upon sites 20MQ90 and 20MQ91 as long as provisions for their protection were included in the transfer documents. Such provisions could be deed restrictions which provide for the preservation of the sites in place. It may also be stipulated, however, that if preservation in place became unfeasible, adequate and appropriate mitigation measures would be implemented

to recover and preserve the data present at the sites. These contingencies would be spelled out in the covenant.

We will continue to work with the Air Force in developing necessary provisions for protection of the sites to be included in the transfer documents. If you have any questions, please contact Kristine Wilson, Environmental Review Coordinator, at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

A handwritten signature in cursive script, appearing to read "Kathryn B. Eckert".

Kathryn B. Eckert
State Historic Preservation Officer

KBE:DLA:kmw

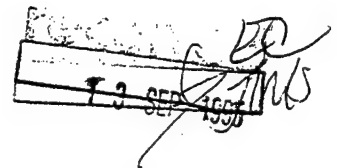


MICHIGAN DEPARTMENT OF STATE
Candice S. Miller, Secretary of State

Lansing, Michigan 48918-0001

STATE HISTORIC PRESERVATION OFFICE

Michigan Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800



September 1, 1995

MR BRUCE R LEIGHTON PE
DEPARTMENT OF AIR FORCE
HQ AFCEE EC
8106 CHENNAULT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 Historic Building Inventory evaluation, K.I. Sawyer AFB, Marquette
County (USAF)

Dear Mr. Leighton:

Under the authority of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited project at the location noted above. It is the opinion of the State Historic Preservation Officer (SHPO) that the project will affect no historic properties (no known sites eligible for listing in the National Register of Historic Places) and that the project is cleared under federal regulation 36 CFR 800 for the "Protection of Historic Properties."

Please maintain a copy of this letter with your environmental review record for this project. If the scope of work changes in any way, or if artifacts or bones are discovered, please contact this office immediately. This letter evidences your compliance with 36 CFR 800.4, "Identifying Historic Properties," and the fulfillment of your responsibility to notify this office under 36 CFR 800.4(d), "When no historic properties found."

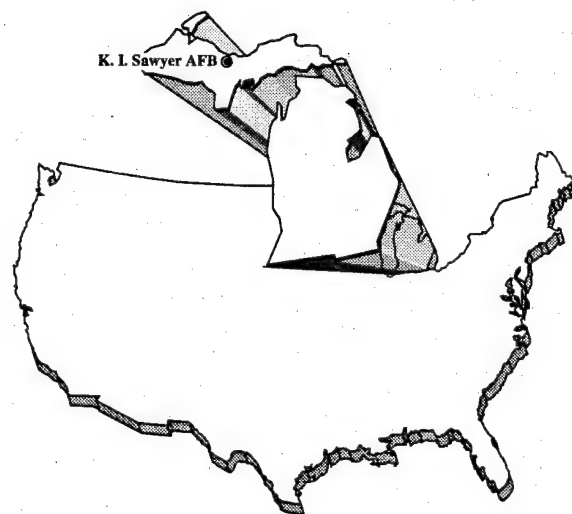
If you have any questions, please contact Kristine Wilson, Environmental Review Coordinator, at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

Kathryn B. Eckert
State Historic Preservation Officer

KBE:BDC:cm

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APPENDIX N

APPENDIX N

**INFLUENCING FACTORS AND ENVIRONMENTAL IMPACTS
BY LAND USE CATEGORY**

APPENDIX N

INFLUENCING FACTORS AND ENVIRONMENTAL IMPACTS BY LAND USE CATEGORY

INTRODUCTION

The purpose of this appendix is to quantify the environmental impacts of each land use category identified for the four alternatives, including the Proposed Action, evaluated in this Environmental Impact Statement (EIS). The data in Tables N-1 through N-16 present the impacts of individual land use activities, such as industrial, commercial, or institutional, on their respective Regions of Influence and allow comparison of the impacts of the Proposed Action and alternatives for three benchmark years, 2000, 2005, and 2015, where applicable. Figures N-1 through N-4 display the parcels in the various land use categories for the Proposed Action and alternatives.

Tables N-1 through N-4 present data on the influencing factors (factors that drive environmental impacts); Tables N-5 through N-16 list the impacts on individual environmental resources evaluated in the EIS. These resources include transportation, utilities, hazardous materials and hazardous waste management, geology and soils, water resources, air quality, noise, biological resources, and cultural resources. This appendix includes at least one table for each resource area, except water resources and air quality. Data on water demand are presented as part of the utilities analysis; the effects on surface and groundwater resources in and around the base have not been quantified in the EIS and have not been disaggregated in this appendix. The air emissions associated with each alternative for each benchmark year are described in detail in Appendix I and have not been included in this appendix.

No quantification is provided in Table N-11 because the quantities of hazardous materials used and hazardous wastes generated will depend on the type and intensity of industrial and commercial activities developed on the site. Table N-11 presents a generalized description of the hazardous materials used under individual land use categories. Table N-12 summarizes the number of Installation Restoration Program (IRP) sites identified on the base as of 1994, but does not give the likely status of these sites in 2000, 2005, and 2015.

Factors and assumptions used in disaggregating the total impacts of an alternative into individual land use categories are presented as footnotes on the relevant tables.

Table N-1. Direct Employment by Land Use Category, K. I. Sawyer AFB Reuse

Land Use Category	2000				2005				2015			
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	245	527	391	NA	476	759	748	NA	951	1,030	779	NA
Industrial	2,090	463	347	174	3,963	839	408	215	7,705	1,586	602	291
Institutional (medical/educational)	13	249	238	28	31	236	391	50	59	234	623	103
Commercial	266	263	76	57	527	509	119	107	1,040	1,000	200	214
Residential	0	6	0	4	0	10	0	6	0	11	0	9
Public facilities/recreation	41	31	33	142	56	33	34	253	89	33	22	239
Agriculture	0	0	0	NA	0	0	0	NA	0	0	0	NA
Military	63	NA	NA	NA	61	NA	NA	NA	59	NA	NA	NA
Total	2,718	1,539	1,085	405	5,114	2,386	1,700	631	9,903	3,894	2,226	856

Table N-2. Total Employment by Land Use Category, K. I. Sawyer AFB Reuse

Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	425	854	648	NA	831	1,258	1,235	NA	1,667	1,674	1,262	NA
Industrial	3,627	753	576	246	6,924	1,376	673	303	13,511	2,574	973	421
Institutional (medical/educational)	24	402	396	40	54	393	646	71	104	386	1,009	149
Commercial	462	427	126	80	920	825	196	152	1,824	1,673	325	310
Residential	0	25	0	6	0	39	0	9	0	64	0	12
Public facilities/recreation	71	50	55	200	98	39	56	357	156	64	36	347
Agriculture	0	0	0	NA	0	0	0	NA	0	0	0	NA
Military	108	NA	NA	NA	107	NA	NA	NA	104	NA	NA	NA
Total	4,717	2,511	1,801	572	8,934	3,930	2,806	892	17,366	6,435	3,605	1,239

Note: Total employment includes direct and secondary employment.

Alt. 1 = International Wayport Alternative

Alt. 2 = Commercial Aviation Alternative

Alt. 3 = Recreation Alternative

NA = not applicable

P.A. = Proposed Action

Table N-3. Population In-Migration by Land Use Category, K. I. Sawyer AFB Reuse

Land Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	227	480	358	NA	466	739	724	NA	1,006	1,055	805	NA
Industrial	1,944	423	318	151	3,886	808	395	201	8,156	1,621	621	293
Institutional (medical/educational)	13	226	219	25	30	231	378	47	63	243	644	104
Commercial	248	240	70	48	517	485	115	101	1,101	1,055	207	215
Residential	0	14	0	4	0	23	0	6	0	41	0	9
Public facilities/recreation	38	28	30	123	55	23	33	237	94	41	24	242
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	58	NA	NA	NA	60	NA	NA	NA	63	NA	NA	NA
Total	2,528	1,411	995	351	5,014	2,309	1,645	592	10,483	4,056	2,301	863

Note: Population in-migration is based on projected total employment for each land use category.

Table N-4. Land Use Impacts by Land Use Category, K. I. Sawyer AFB Reuse (acres of absorption)

Land Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	1,156	814	510	NA	1,156	814	510	NA	1,156	1,055	510	NA
Aviation support	80	128	158	NA	159	189	316	NA	319	260	325	NA
Industrial	295	181	105	59	545	234	159	71	1,047	340	272	89
Institutional (medical/educational)	4	162	167	13	9	162	303	27	17	161	546	56
Commercial	11	17	5	2	22	32	7	5	43	63	10	10
Residential	38	269	37	15	76	377	74	30	152	538	147	60
Public facilities/recreation	393	1,118	1,387	2,078	560	1,118	1,387	3,986	896	1,118	1,387	3,986
Agriculture	NA	874	1,489	NA	NA	874	1,489	NA	NA	874	1,489	NA
Military	193	NA	NA	NA	193	NA	NA	NA	193	NA	NA	NA
Total	2,170	3,563	3,858	2,167	2,720	3,800	4,245	4,119	3,822	4,409	4,686	4,201

Alt. 1 = International Wayport Alternative

Alt. 2 = Commercial Aviation Alternative

Alt. 3 = Recreation Alternative

NA = not applicable

P.A. = Proposed Action

K. I. Sawyer AFB Disposal FEIS

Table N-5. Transportation Impacts by Land Use Category, K. I. Sawyer AFB Reuse (average daily trips)

Land Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	796	1,654	1,440	NA	1,590	2,488	2,892	NA	3,156	3,450	3,045	NA
Industrial	6,073	1,435	753	234	11,951	2,657	913	356	23,728	5,110	1,345	558
Institutional (medical/educational)	23	3,885	3,369	234	45	3,872	6,042	489	90	3,872	10,760	992
Commercial	827	1,896	781	130	1,653	3,705	1,465	267	3,307	7,336	2,701	496
Residential	683	5,191	631	390	1,365	7,242	1,262	757	2,730	10,345	2,523	1,550
Public facilities/recreational	315	289	326	1,612	463	286	326	2,581	756	287	326	2,604
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	183	NA	NA	NA	183	NA	NA	NA	183	NA	NA	NA
Total	8,900	14,350	7,300	2,600	17,250	20,250	12,900	4,450	33,950	30,400	20,700	6,200

Note: The number of vehicle trips expected as a result of specific land uses was estimated on the basis of direct on-site jobs and other attributes of on-site land uses (such as the number of dwelling units, commercial and industrial development, and other factors).

Table N-6. Water Consumption by Land Use Category, K. I. Sawyer AFB Reuse (gallons per day)

Land Use Category	2000				2005				2015			
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	31,500	28,800	84,000	NA	63,400	50,000	160,000	NA	130,000	74,000	197,600	NA
Industrial	803,100	21,600	17,500	2,000	1,611,700	40,000	25,600	3,400	3,290,300	88,800	41,600	5,400
Institutional (medical/educational)	1,100	194,400	150,500	16,000	2,300	210,000	294,400	32,300	4,500	236,800	540,800	62,100
Commercial	7,900	7,200	3,500	2,000	15,900	10,000	6,400	3,400	32,600	29,600	5,200	8,100
Residential	67,700	446,400	63,000	40,000	136,300	670,000	121,600	83,300	278,100	1,021,200	228,800	151,200
Public facilities/recreation	32,900	21,600	31,500	40,000	34,500	20,000	32,000	47,600	38,200	29,600	26,000	43,200
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	15,800	NA	NA	NA	15,900	NA	NA	NA	16,300	NA	NA	NA
Total	960,000	720,000	350,000	100,000	1,880,000	1,000,000	640,000	170,000	3,790,000	1,480,000	1,040,000	270,000

Alt. 1 = International Wayport Alternative
 Alt. 2 = Commercial Aviation Alternative
 Alt. 3 = Recreation Alternative
 NA = not applicable
 P.A. = Proposed Action

Table N-7. Wastewater Generation by Land Use Category, K. I. Sawyer AFB Reuse (gallons per day)

Land Use Category	2000				2005				2015			
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	42,700	24,000	70,000	NA	85,900	42,000	132,600	NA	177,900	62,000	154,800	NA
Industrial	302,400	18,000	16,800	1,400	601,900	33,600	20,400	2,600	1,240,700	74,400	34,400	4,200
Institutional (medical/educational)	1,600	162,000	134,400	17,500	3,300	176,400	244,800	32,500	6,600	198,400	464,400	56,700
Commercial	10,700	6,000	1,400	2,100	21,500	8,400	2,550	3,900	44,600	24,800	4,300	6,300
Residential	91,900	384,000	56,000	44,800	184,700	579,600	107,100	83,200	382,700	880,400	197,800	136,500
Public facilities/ recreation	1,900	6,000	1,400	4,200	3,800	0	2,550	7,800	7,900	0	4,300	6,300
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	18,800	NA	NA	NA	18,900	NA	NA	NA	19,800	NA	NA	NA
Total	470,000	600,000	280,000	70,000	920,000	840,000	510,000	130,000	1,880,000	1,240,000	860,000	210,000

Table N-8. Solid Waste Generation by Land Use Category, K. I. Sawyer AFB Reuse (tons per day)

Land Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	0.87	1.27	1.14	NA	1.75	1.79	2.25	NA	3.61	2.70	2.52	NA
Industrial	7.21	1.41	1.14	0.07	14.08	2.39	1.54	0.17	28.53	4.20	2.33	0.34
Institutional (medical/educational)	0.05	3.67	3.01	0.35	0.10	3.79	5.68	0.66	0.21	4.20	10.27	1.43
Commercial	1.04	0.56	0.20	0.19	2.10	1.40	0.24	0.35	4.32	2.70	0.48	0.17
Residential	1.48	7.19	1.00	0.76	3.00	10.57	2.01	1.38	6.18	16.17	3.69	1.83
Public facilities/recreation	0.09	0	0.20	0.48	0.18	0	0.11	0.90	0.37	0	0.09	1.94
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	0.82	NA	NA	NA	0.83	NA	NA	NA	0.86	NA	NA	NA
Total	11.56	14.10	6.69	1.85	22.04	19.94	11.83	3.46	44.08	29.97	19.38	5.71

Alt. 1	=	International	Wayport	Alternative
Alt. 2	=	Commercial	Aviation	Alternative
Alt. 3	=	Recreation	Alternative	
NA	=	not applicable		
P.A.	=	Proposed Action		

Table N-9. Electricity Demand by Land Use Category, K. I. Sawyer AFB Reuse (megawatt-hours per day)

Land Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	4.68	7.94	7.20	NA	9.40	11.85	14.19	NA	19.18	16.92	15.84	NA
Industrial	37.01	11.12	6.13	0.48	69.21	16.16	8.39	1.25	135.98	26.15	12.67	2.30
Institutional (medical/educational)	0.75	19.06	17.30	1.99	1.47	19.39	31.61	3.91	2.98	21.54	58.09	7.68
Commercial	1.97	1.59	0.36	0.24	3.96	3.23	0.64	0.47	8.08	6.15	1.06	1.02
Residential	6.72	38.91	5.05	2.56	13.51	56.01	9.68	4.84	27.56	81.54	17.95	9.47
Public facilities/recreation	2.39	0.79	0	2.72	4.80	1.08	0	5.15	9.80	1.54	0	5.12
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	1.54	NA	NA	NA	1.55	NA	NA	NA	1.58	NA	NA	NA
Total	55.06	79.41	36.04	7.99	103.90	107.72	64.51	15.62	205.16	153.84	105.61	25.59

Table N-10. Natural Gas Demand by Land Use Category, K. I. Sawyer AFB Reuse (therms per day)

Land Use Category	2000			2005			2015					
	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	47,500	79,200	58,500	NA	97,400	118,800	122,400	NA	203,800	175,200	118,800	NA
Industrial	401,700	108,000	89,700	809,600	763,500	168,300	122,400	833,000	1,522,000	292,000	205,200	872,000
Institutional (medical/educational)	15,200	208,800	198,900	17,600	29,600	227,700	353,600	49,000	59,600	233,600	604,800	87,200
Commercial	39,000	28,800	7,800	8,800	81,700	59,400	13,600	9,800	167,700	116,800	21,600	10,900
Residential	54,200	280,800	35,100	8,800	111,300	396,000	68,000	29,400	230,800	627,800	129,600	54,500
Public facilities/recreation	30,500	14,400	0	35,200	64,300	19,800	0	58,800	133,500	14,600	0	65,400
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	11,900	NA	NA	NA	12,200	NA	NA	NA	12,600	NA	NA	NA
Total	600,000	720,000	390,000	880,000	1,160,000	990,000	680,000	980,000	2,330,000	1,460,000	1,080,000	1,090,000

Alt. 1 = International Waypoint Alternative
 Alt. 2 = Commercial Aviation Alternative
 Alt. 3 = Recreation Alternative
 NA = not applicable
 P.A. = Proposed Action

Table N-11. Hazardous Materials Usage by Land Use Category, K. I. Sawyer AFB Reuse, 2000-2015

Land Use Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative
Airfield				
	Aviation fuels, glycols, hydraulic fluids, POL	Aviation fuels, glycols, hydraulic fluids, POL	Aviation fuels, glycols, hydraulic fluids, POL	NA
Aviation support	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners	NA
Industrial	Aerosols, cleaners, corrosives, degreasers, heating oil, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners	Aerosols, cleaners, corrosives, degreasers, heating oil, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners	Aerosols, cleaners, corrosives, degreasers, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners	Aerosols, cleaners, corrosives, degreasers, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners
Institutional (medical/educational)	Heating oils, household products, paints, pesticides, pharmaceuticals, POL, radiological sources, thinners	Cleaners, corrosives, fertilizers, heating oils, household products, ignitables, motor fuels, paints, pesticides, pharmaceuticals, POL, radiological sources, small arms ammunition, solvents, thinners	Batteries, cleaners, corrosives, fertilizers, heating oils, household products, motor fuels, paints, pesticides, pharmaceuticals, POL, radiological sources, small arms ammunition, thinners, water softening chemicals	Aerosols, cleaners, corrosives, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, solvents, thinners
Commercial	Heating oils, household products, paints, pesticides, thinners	Aerosols, batteries, cleaners, corrosives, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, solvents, thinners	Aerosols, corrosives, heating oils, household products, paints, pesticides, POL, thinners	Heating oils, household products, paints, pesticides, thinners
Residential	Cleaners, fertilizers, household products, motor fuels, oils, pesticides	Cleaners, fertilizers, household products, motor fuels, oils, pesticides	Cleaners, fertilizers, household products, motor fuels, paints, pesticides, POL, thinners	Cleaners, fertilizers, household products, motor fuels, paints, pesticides, POL, thinners
Public facilities/recreation	Aerosols, chlorine, cleaners, fertilizers, heating oils, motor fuels, paints, pesticides, POL, small arms ammunition, solvents, thinners	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, solvents, thinners	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, thinners	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, thinners
Agriculture	NA	Motor fuels, pesticides, POL	Motor fuels, pesticides, POL	NA
Military	Batteries, cleaners, corrosives, glycols, household products, ignitables, motor fuels, paint, POL, small arms ammunition, solvents, thinners	NA	NA	NA

Note: Quantities of hazardous materials used will depend on the specific industrial development and are not reported here.

NA = not applicable

POL = petroleum, oil, and lubricants

Table N-12. Number of Installation Restoration Program Sites by Land Use Category, K. I. Sawyer AFB Reuse

Land Use Category	1994			
	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	6	4	0	NA
Aviation support	6	8	7	NA
Industrial	7	5	2	9
Institutional (medical/educational)	0	2	7	3
Commercial	2	3	0	0
Residential	0	0	0	0
Public facilities/recreation	7	4	4	13
Agriculture	NA	3	5	NA
Military	0	NA	NA	NA

Note: Table shows Installation Restoration Program sites as of 1994. The number of sites over the 1994-2015 period would change as remediation measures are implemented for individual sites.

Table N-13. Geology and Soils Impacts by Land Use Category, K. I. Sawyer AFB Reuse, 2000-2015 (acres of ground disturbance)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	94	0	NA
Aviation support	56	74	9	NA
Industrial	620	121	29	7
Institutional (medical/educational)	1	0	11	3
Commercial	0	3	1	1
Residential	4	0	0	0
Public facilities/recreation	0	0	61	190
Agriculture	NA	88	148	NA
Military	0	NA	NA	NA
Total	681	380	259	201

Note: Disturbance of soils would depend upon the construction schedules of various facilities on base. Therefore, no breakdown is provided for the benchmark years 2000, 2005, and 2015.

Alt. 1 = International Waypoint Alternative

Alt. 2 = Commercial Aviation Alternative

Alt. 3 = Recreation Alternative

NA = not applicable

P.A. = Proposed Action

Table N-14. Expected Noise Levels by Land Use Category, K. I. Sawyer AFB Reuse, 2000-2015
(typical day-night average sound level in decibels)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	65-75	65-75	65-75	NA
Aviation support	< 65	65-75	< 65	NA
Industrial	< 65	65-75	< 65	< 65
Institutional (medical/educational)	< 65	< 65	< 65	< 65
Commercial	< 65	< 65	< 65	< 65
Residential	< 65	< 65	< 65	< 65
Public facilities/recreation	< 65	65-70	< 65	< 65
Agriculture	NA	65-70	65-75	NA
Military	< 65	NA	NA	NA

< = less than

Table N-15. Biological Resource Impacts by Land Use Category, K. I. Sawyer AFB Reuse
(acres of wetland habitat disturbed)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0.0	2	0.0	NA
Aviation support	0.5	0.5	0.5	NA
Industrial	2	0.5	1	2
Institutional (medical)	0.0	0.0	NA	NA
Institutional (educational)	0.0	0.0	2.5	0.0
Commercial	0.0	0.0	0.0	0.0
Residential	0.0	0.0	0.0	0.0
Public facilities/recreation	0.0	0.0	0.0	0.5
Agriculture	NA	5.5	5.5	NA
Military	0.0	NA	NA	NA
Total	2.5	8.5	9.5	2.5

Note: Disturbance over the 2000-2015 period.
 Alt. 1 = International Wayport Alternative
 Alt. 2 = Commercial Aviation Alternative
 Alt. 3 = Recreation Alternative
 NA = not applicable
 P.A. = Proposed Action

Table N-16. Cultural Resource by Land Use Category, K. I. Sawyer AFB Reuse (number of potential historic properties)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA
Aviation Support	0	0	0	NA
Industrial	0	0	0	0
Institutional (medical/educational)	0	0	0	0
Commercial	0	0	0	0
Residential	0	0	0	0
Public facilities/recreation	2	2	2	2
Agriculture	NA	0	0	NA
Military	0	NA	NA	NA

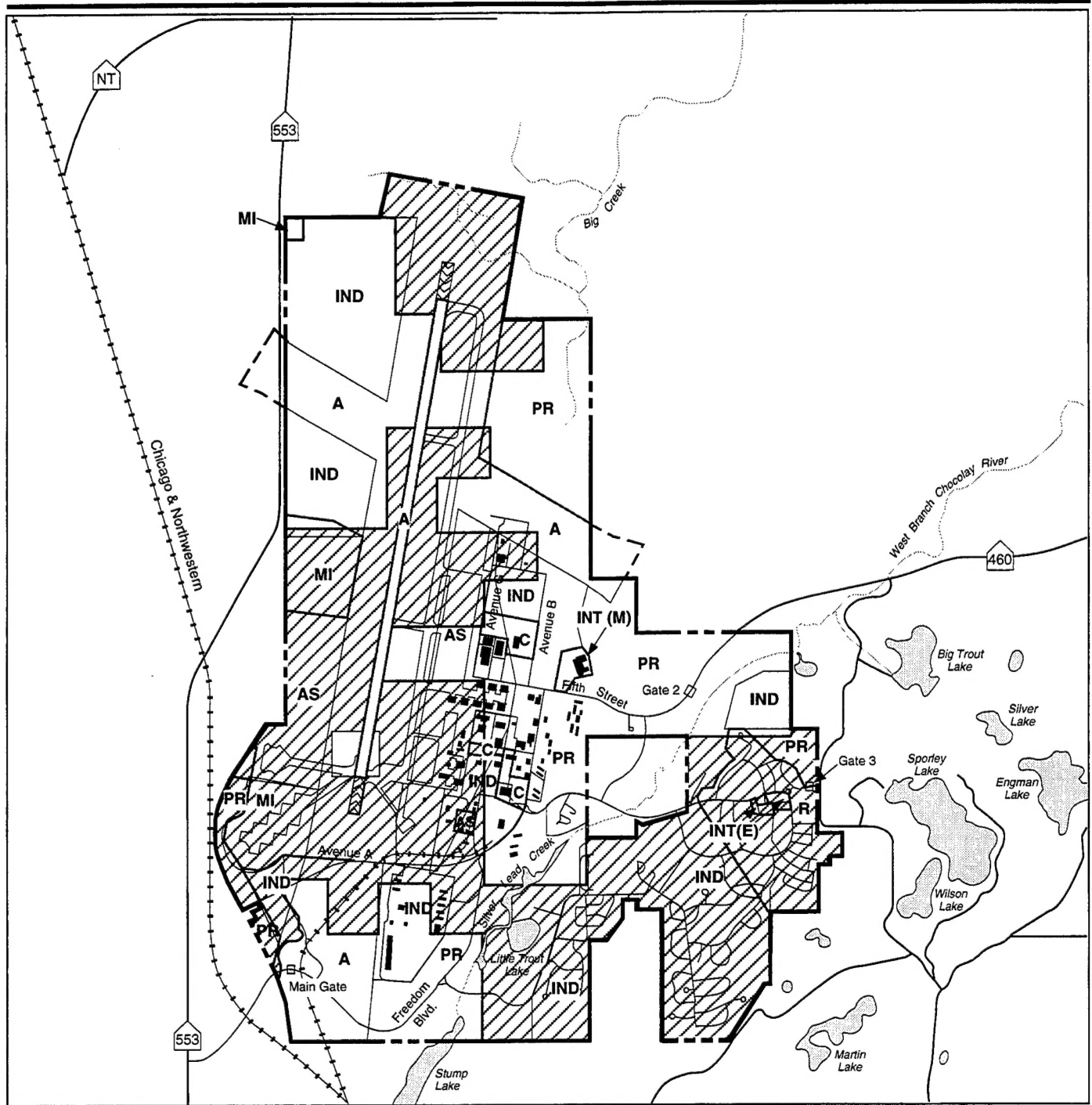
Alt. 1 = International Wayport Alternative

Alt. 2 = Commercial Aviation Alternative

Alt. 3 = Recreation Alternative

NA = Not applicable

P.A. = Proposed Action



EXPLANATION

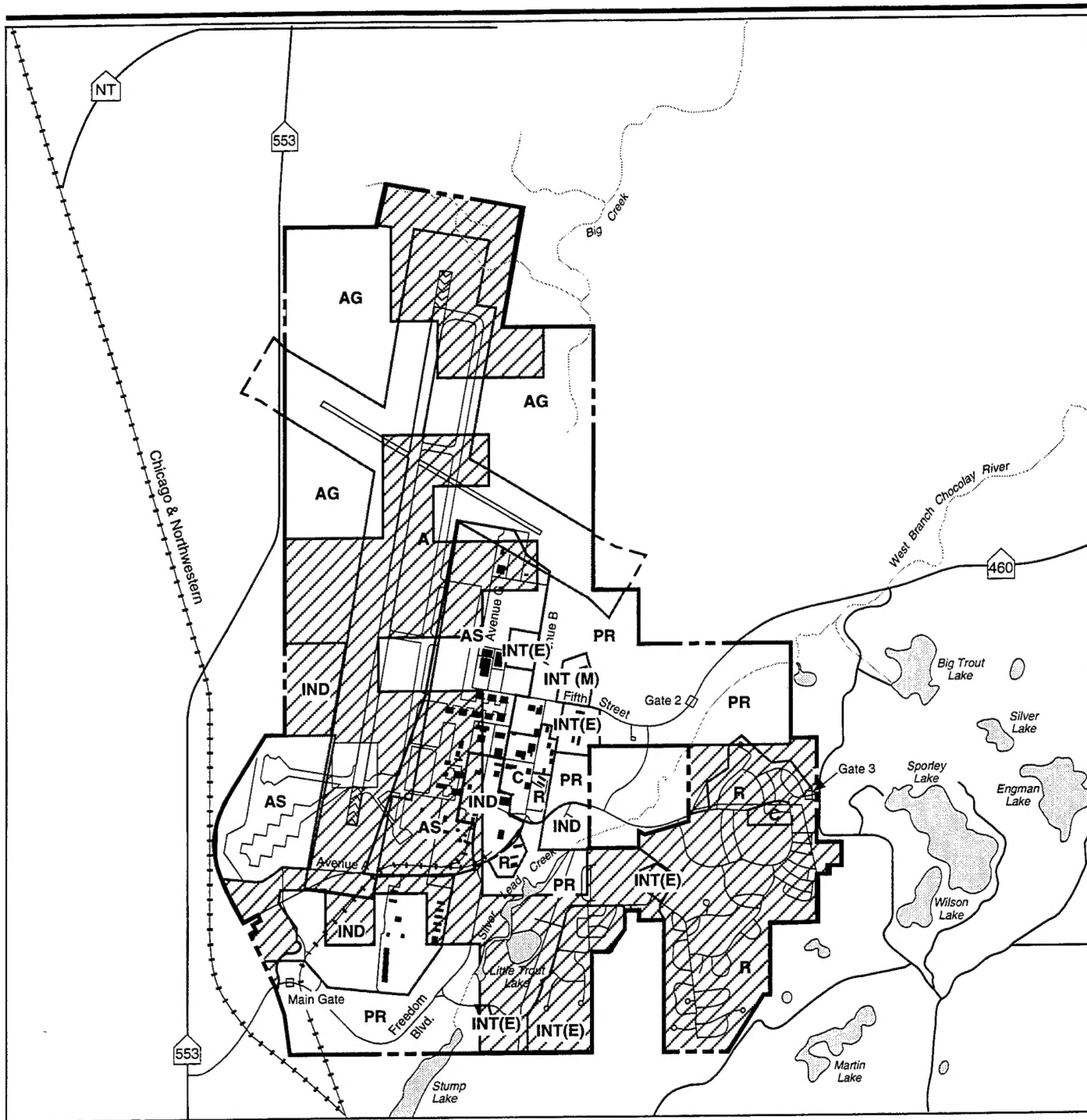
A	Airfield - 1,397 ac.	INT(E)	Institutional (Educational) - 8 ac.	AG	Agriculture*
AS	Aviation Support - 455 ac.	C	Commercial - 43 ac.	MI	Military - 193 ac.
IND	Industrial - 1,476 ac.	R	Residential - 152 ac.		Air Force Fee-Owned
INT (M)	Institutional (Medical) - 16 ac.	PR	Public Facilities/ Recreation - 1,183 ac.		Base Boundary



* Standard land use designation not applicable to this figure.

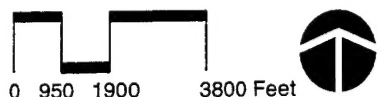
Land Use Parcels- Proposed Action

Figure N-1



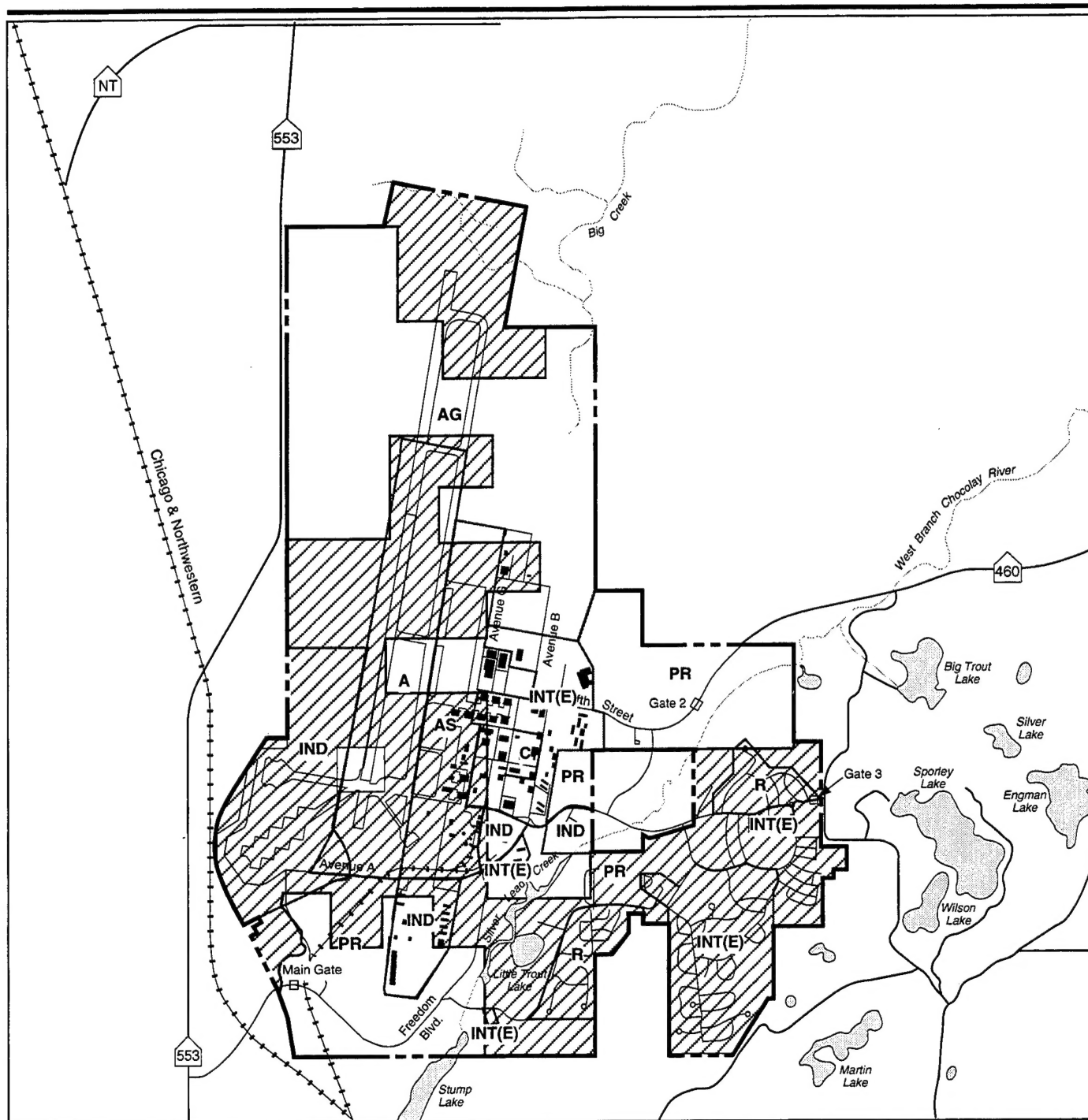
EXPLANATION

A	Airfield - 1,055 ac.	INT(E)	Institutional (Educational) - 138 ac.	AG	Agriculture - 874 ac.
AS	Aviation Support - 617 ac.	C	Commercial - 64 ac.		Air Force Fee-Owned
IND	Industrial - 495 ac.	R	Residential - 538 ac.		Base Boundary
INT (M)	Institutional (Medical) - 24 ac.	PR	Public Facilities/ Recreation - 1,118 ac.		





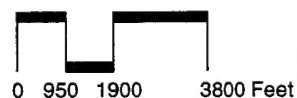
Land Use Parcels - International Wayport Alternative

Figure N-2



EXPLANATION

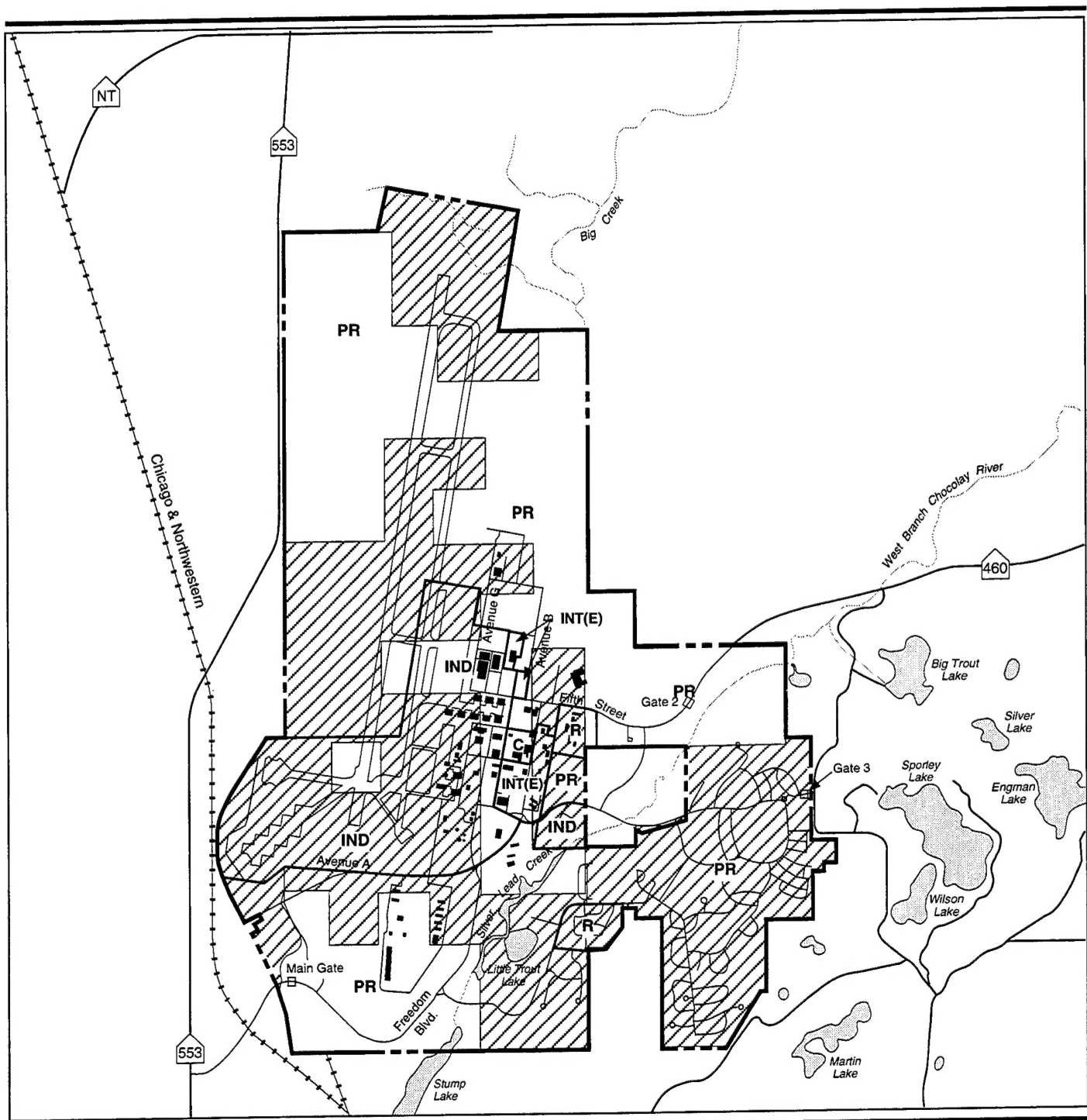
A Airfield - 510 ac.	INT(E) Institutional (Educational) - 546 ac.	AG Agriculture - 1,489 ac.
AS Aviation Support - 325 ac.	C Commercial - 25 ac.	 Air Force Fee-Owned
IND Industrial - 494 ac.	R Residential - 147 ac.	 Base Boundary
INT (M) Institutional (Medical) *	PR Public Facilities/ Recreation - 1,387 ac.	





* Standard land use designation not applicable to this figure.

Land Use Parcels - Commercial Aviation Alternative

Figure N-3



EXPLANATION

A	Airfield *	INT (E)	Institutional (Educational) - 67 ac.	AG	Agriculture *
AS	Aviation Support *	C	Commercial - 13 ac.		Air Force Fee-Owned
IND	Industrial - 797 ac.	R	Residential - 60 ac.		Base Boundary
INT (M)	Institutional (Medical) *	PR	Public Facilities/ Recreation - 3,986 ac.		



* Standard land use designation not applicable to this figure.

Land Use Parcels- Recreation Alternative

Figure N-4